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Electrical World

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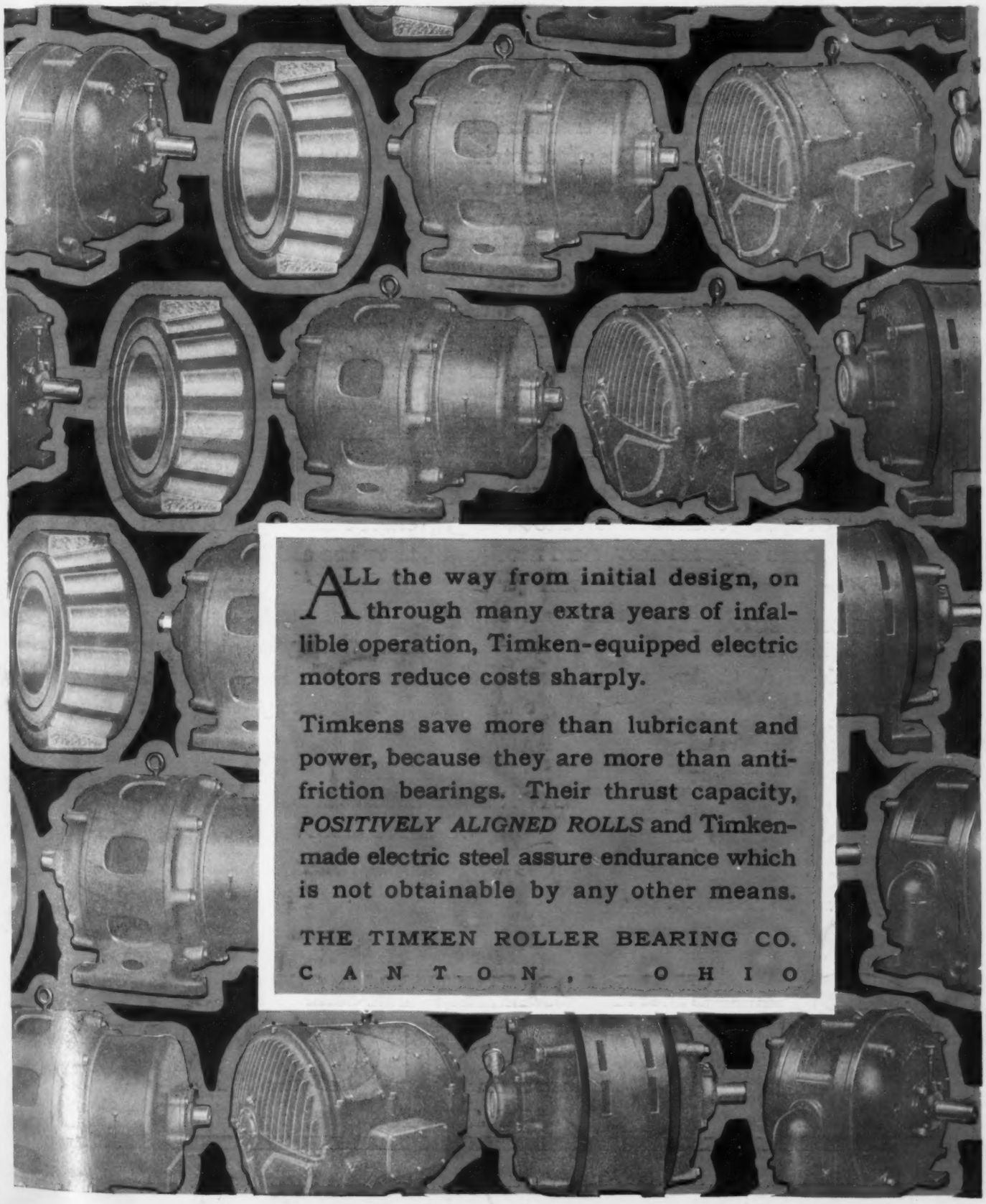

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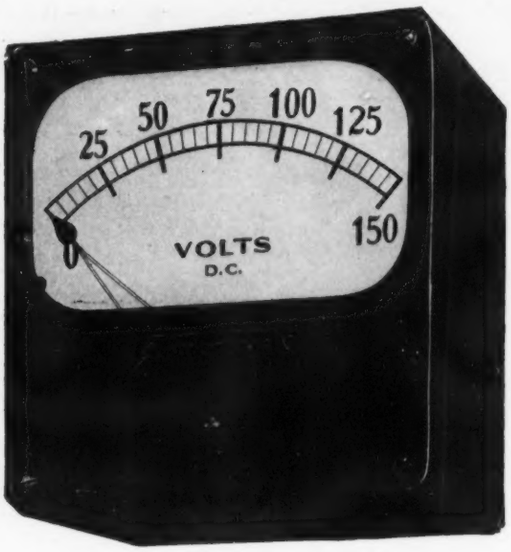

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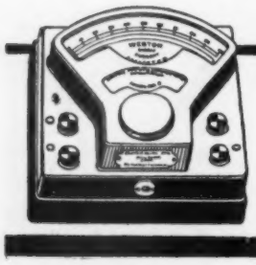

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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

W. H. ONKEN, JR., *Editor*

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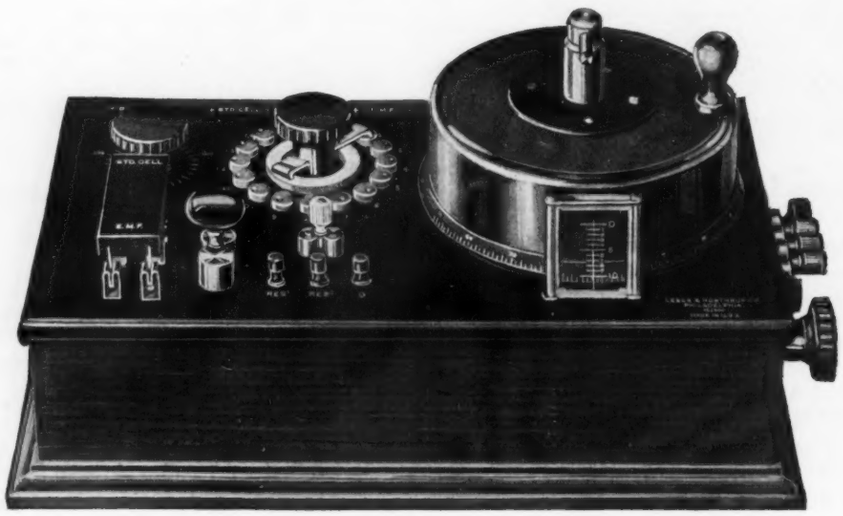

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 89 — *New York, Saturday, January 29, 1927* — NUMBER 5

Electrical Manufacture Loses a Chieftain

ANSON W. BURCHARD was a devotee and disciple of "big business." Educated as a mechanical engineer, he forsook that calling early in life at the behest of his brilliant fellow-townsman and brother-in-law, the late Hinsdill Parsons, vice-president and general counsel of the General Electric Company. Soon after his association twenty-five years ago with the latter company Mr. Burchard engaged in strengthening it. In the amalgamation and final absorption of the great independent manufacturers of incandescent lamps into the General Electric organization he played a most prominent part. He was especially skilled and fitted temperamentally as an organizer, and his abilities were recognized abroad as well as at home. In the domain of corporate finance he was most versatile, and he was better known in the offices of the holding companies and large corporations than among the rank and file of electric light and power operators.

While a life devoted to great and important work of the kind Mr. Burchard delighted to engage in removed him more or less from intimate human contact with operators, Mr. Burchard's contributions to the industry's progress were great and lasting. His activities in welding together corporations and manufacturing organizations made the work of standardization and simplification that much easier, and from it therefore not only the electrical industry but the purchasers of electric lamps and apparatus derived advantage. Toward the establishment of an ideal business and manufacturing enterprise, in which the seller and buyer both gain, Mr. Burchard's contributions were priceless. In his death the numerous corporations with which he was associated lose a sagacious counselor and the electrical industry one of its outstanding men.

Where the "Glad Hand" Wins

EXECUTIVES of electric light and power companies are not necessarily publicists, and hence not many of them possess keen news sense or an appreciation of what constitutes news value. The public utility companies maintain contact intimately with every householder in the community and are themselves the largest taxpayers. Anything, therefore, which affects the public utilities and through them the general public is news, and it is surprising what an interest the public takes in public utility matters.

For example, if an electric public utility company opens a new power house, the public is interested and great numbers of citizens will avail themselves of the privilege of visiting it if an invitation to do so is extended to them. Experience shows that few persons have any comprehension of what the interior of a power house looks like and fewer still of the importance of the utility to the community. What an opportunity exists, then, to acquaint the consumer with these facts so that he too may take pride in the accomplishments of the utility company and indirectly may be informed on the process, cost and economic significance of electric service! Such utilities as the Niagara Falls Power Company, which makes it a point regularly to entertain thousands of sightseers, and others like the Columbia Gas & Electric, the Public Service Electric & Gas and the New York Edison, which have recently dedicated new stations publicly and ceremoniously, have found the time and cost expended on such occasions more than justified. The public is interested in things electrical, and the electric utility company which does not offer its patrons a chance to inspect its new power house or office building is neglecting a great opportunity.

Executive Readjustments in Holding Companies

BELOW the surface in the rising tide of holding-company expansion lies no little unsettlement of mind among many executives whose lives have been devoted to the upbuilding of individual light and power properties. Centralized management has come to stay, and as it comes these men are not to be blamed for questioning the effect of this movement upon their companies and upon their personal prospects. The right mental attitude toward the situation is extremely important, for upon this attitude in the long run depends the whole prospect of future usefulness of these experienced executives under the new régime.

Holding companies are of many kinds and policies. An open mind on the part of the single-company executive is the first essential when facing a transfer of control. Coupled with this should be a determination to co-operate to the limit with the new organization as long as one remains with it. The policy of the best-managed holding companies is to throw the door of opportunity wide open before the executives active in the former administration. As in all other lines of business, it sometimes happens that sweeping changes are put into effect when control passes—changes which are too great to warrant continued service on the part of the previous régime. The important thing, however, is not to miss any real opportunities to serve a new management if reasonable conditions appear to be in prospect and to shun prejudice as a pestilence.

Many executives of acquired companies are now men of years. Their value to a new organization may be almost beyond conception provided that their minds are receptive and their wills determined to make a success

of things under the new dispensation. With the new organization at work, the outlook should broaden. Cheeseparing economies should give way to reasonable expenditures to obtain necessary results on time schedules synchronizing with holding-company standards. Executives should take part in group company conferences and conventions with alert interest and should be both seen and heard—but heard to the point. They should speak well of the new organization among employees and friends. They should do their utmost to secure and maintain co-operation by the entire staff in the operation of the property along new lines, in engineering, sales activity and accounting, with the adoption when required of new and unfamiliar forms of reports.

Under the right conditions a change of control spells opportunity in capital letters to many an executive, and from every standpoint it is important for such men to see in such opportunity a challenge to the best that is in them. The reward of a right response can be seen today in the executive personnel of holding and operating companies from one end of the country to the other.

Economies in Transmission Construction

EVERY central-station company has worked out for itself a method for constructing steel-tower lines, and these methods differ widely. Long experience in line building is needed to determine the most satisfactory methods to use, and the experiences and practices of the older transmission companies can well be studied.

The type of country traversed and other local conditions affect any particular method, but do not affect the general application of principles which may reduce labor costs as much as 50 per cent. The company that builds a 110,000-volt double-circuit steel-tower line at a construction-labor cost of $1,100 per mile is operating on a far more efficient basis than one that spends $2,200 per mile for the same work. If the project is organized carefully, four men may be able to erect a tower in the same time that eight men take.

Too much idle time in transporting line materials and workmen results in high costs. Tower manufacture on a precision basis so that all holes match and all members fit readily is essential to quick and economical erection. The specification of joints in towers at places which permit erectors to do the job of field assembly quickly and conveniently is a point often overlooked. The selection of erecting tools and digging tools requires considerable thought, but will bring returns in lower costs. Most territory has a natural contour which gives a ruling tower spacing, and this fact can be used to advantage.

If money is to be saved, every transmission project should be organized in detail before it is started. Schedules can be made so that all material for a tower can be delivered at one visit to each tower site, and many advantages will be found in the practice of building towers from the ground up by using a specialized digging crew, a specialized erecting crew and tower specifications. Competent foremen will always speed up the slowest part of the operations, for this governs the speed with which the work progresses. More lines can be built for the same money if due attention be given to a reduction in the cost of erection.

Symposium on Voltage Standardization

AT THE winter meeting of the American Institute of Electrical Engineers there will be a symposium of papers on voltage standardization. The general proposal is to standardize voltages from the generator to the device that uses the energy. The basic idea is that economics will result if the number of voltages in use is reduced and if those which are retained allow for voltage drop from generator to utilization equipment. This is not the situation now.

Manufacturers, utility companies and consulting engineers will discuss this highly important topic at the meeting. There will be great differences in opinion and much debate, but the open forum will result in good. It will clarify the problem and perhaps lead to definite progress toward voltage standardization. The underlying ideas are sound, but present practices and present economics may modify principles to a degree where only goals can be established toward which progress can be made. Engineers and others discussing the subject should not base their opinions only on their own practices, nor should their discussion be restricted to only one part of the problem, such as transformer standardization.

Voltage standardization is a big question to which no answer has been agreed upon, but it certainly merits the serious consideration of the engineering fraternity, even though many very weighty obstacles to adoption of standardization at present are self-evident.

Co-operation on Fractional-Horsepower Motors

TIME for adjustments and the general application of the principle of co-operation bring progress in the electrical industry. This would seem to furnish the approach to the problem of fractional-horsepower motors. Millions of these motors are already on the lines of central-station companies, and they continue to go on the lines in countless numbers. They are good, bad and indifferent, for they were developed in an intensely commercial atmosphere where competition was keen and where individual service applications were governing elements in their design.

Essentially the consumer or buyer is entitled to the cheapest appliance which will render satisfactory service, and the manufacturer of an appliance attempts to satisfy this principle. But the utility company comes into the picture because rendering satisfactory service to the appliance equipped with an inferior motor may result in unsatisfactory service to other customers or to other appliances of the particular customer. There is no justification for a demand that the company immediately render all services satisfactory to all customers without consideration of the quality of the motors used on the appliances served.

Under these conditions a co-operative solution is a sensible move. The utilities, the motor manufacturers and the appliance manufacturers are concerned, and each has interests which must be considered. Yet each can concede something toward the common good. Utilities will gradually strengthen distribution copper and improve regulation, motor manufacturers will gradually improve their product without increasing

sales prices, and appliance manufacturers will gradually use better motors, for these give better service with less frequent servicing. The great thing is to make a comprehensive study of the situation, where all can understand the complete story, and then make a co-operative plan for improvement. This plan and time will bring about the desired results.

Should Public Utility Companies Service Electric Signs?

THE answer to this question will depend upon the size of the community and upon certain local factors. There is always the advantage of good appearance, for certainly nothing sells electric signs more effectively than the well-maintained signs already in operation; but this factor may seem to be of indefinite or intangible value. Data dealing with revenue should be more convincing.

In a city of fifty thousand inhabitants in an Eastern state the electric service company was supervising the maintenance of 3,794 signs. All other signs in this city totaled 3,136 in number. The total connected load in the maintained signs was 90,320 watts against 61,390 watts in the other group. In the former there was an average of 23.8 watts per socket; in the latter the average was 19.5 watts. This was a difference of 4.3 watts per socket. This means that the average connected load per socket in the maintained signs was 22 per cent greater than in the others. Any central-station executive by using his pencil and the figures peculiar to his own community can transform this increase in connected load into gross and net revenue. Suffice it to state that in a community with the population named the increase in annual gross revenue will be a matter of thousands of dollars. Here is just one of the potential fields for increasing revenue through service which the central station can effectively and efficiently provide. Every lighting department, however large or small, might do well to consider sign maintenance as a regular activity.

Building for System or for Service

THE primary job of a light and power company is to build a system for giving reliable service to its customers. This fact seems to have been forgotten by some utility companies, which have taken a fancy to build system interconnections or to build beautiful transmission lines between generating stations. Styles in the utility business and the pleasure of dealing with something new should not displace fundamental conceptions.

Service to the customers now on the lines and in prospect is the starting point for system planning and system building. Load studies are essential to intelligent system building, and the sole responsibility for giving service to present and future customers rests upon the utility which receives the money for the energy these customers use. The designs of transmission lines, generating stations and interconnections start at the loads, and, fortunately, if started at the loads, the designs always come out best and are easiest to make. Analysis based on the best and most economical service to customers will serve to give correct solutions to many problems which would be debated if systems were built on any other basis.

A twenty-five-year perspective on load developments and load locations is none too long for use in system planning or for use in building system units that will satisfy the requirements of the future. A good measure of intelligent engineering is to build a system based on customer service, so that any station or line when loaded and operated for designed capacity can be left virtually unchanged and yet fit into the future system as developed. It is a good plan to build something, load it, start it in operation and then count on it as a job which has been done and which will always work without much further attention.

Automotive Men Enjoy Greater Rewards than Electrical Men

A CERTAIN executive, for years interested in the marketing problems and processes of the electrical manufacturer and now active in the automotive field, makes an interesting comparison between the rates of profit respectively enjoyed in these two industries. In terms of remuneration, he says, the electrical industry is at fault, first because the profit rate of the business is not right and, second, as a natural corollary of this, because salaries paid in the electrical industry are too low to attract the kind of individual talent that is needed in the development of so great a specialty market. Electrical manufacturers think in terms of about 10 per cent profit. Automobile men think in terms of, say, 20 per cent profit.

Loyal S. Osborne, vice-president of the Westinghouse Electric & Manufacturing Company, in a recent address gave interesting figures in discussing the distribution of the consumer's dollar as spent for electrical merchandise, using the term in its broad sense. Here are the figures expressed in cents:

Manufacturer—Factory cost, 33; distribution, 15; profit, 5.
Jobber—Distribution, 10; profit 2.
Retailer—Distribution, 30; profit, 5.

The total profit realized by the electrical industry, as embraced in this analysis, therefore, is 12 per cent, the total cost of manufacture 33 per cent, and the total cost of distribution 55 per cent. And the two points that stand out most conspicuously are the amount of money that is spent to move the goods from the factory to the consumer and the smallness of the reward for all this service rendered.

Why should the men of the automotive industry enjoy a greater prosperity than electrical men? Is their service to the public more constructive or more helpful or more appreciated? No; rates of profit and standards of remuneration are not established on that basis. But the automotive industry in the beginning was dominated by business men who realized that to build a market for their new idea would require the highest type of imaginative selling. They found their merchandising genius by offering big rewards to men who could produce—salary and bonus—sometimes a short life, but always a merry one. All have observed the success that this policy has brought. And the electrical industry, standing as it does at the threshold of its great era of commercial expansion, would do well to study and appropriate this comparable experience.

Hydro Plants on the Gatineau River Nearing Completion

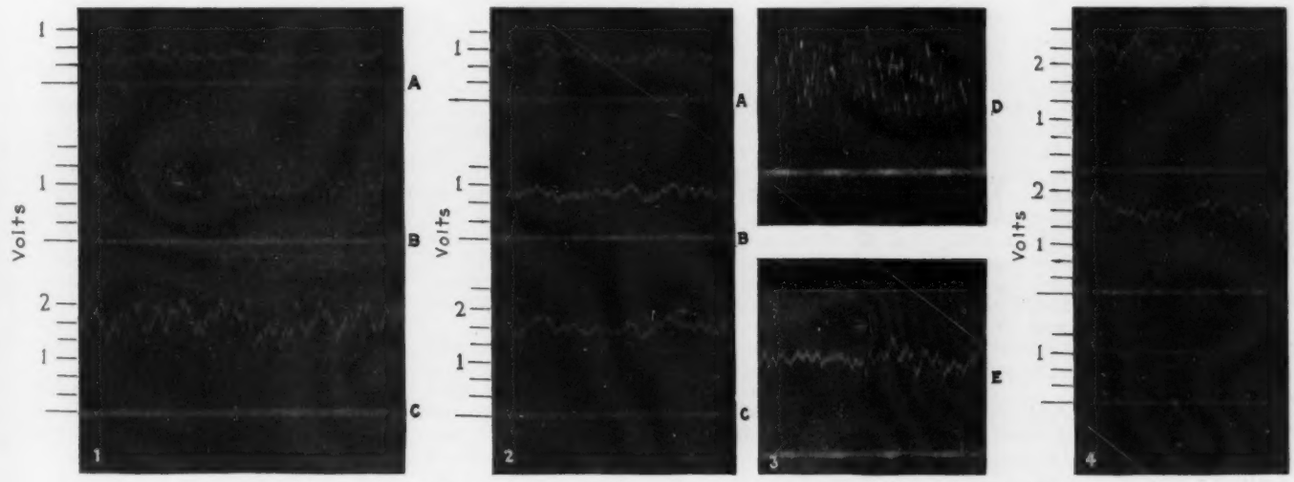
THREE hydro-electric developments, to aggregate 570,000 hp., are being made on the Gatineau River, Canada, a tributary of the Ottawa, within a distance of 33 miles. The International Paper Company is erecting one 170,000-hp. plant at Chelsea, near Ottawa, and another 3 miles downstream at Farmers Rapids which will have a rating of 150,000 hp. Both plants, which are rapidly nearing completion, are shown in the accompanying illustrations, made by the Air Board of Canada for the Water Power and Reclamation Service of the Department of the Interior. About 30 miles above Chelsea, at Paugan Falls, is a 240,000-hp. development. Power from Chelsea and Farmers Rapids is to be used in a huge newsprint plant at West Templeton, Quebec, about 5 miles from Ottawa.

Application of Carbon Brushes to Electrical Machines

Carbon Brushes Are Classified as to Grade and Wearing Characteristics—Their Application to Specific Conditions of Service and Type of Machine Enumerated in Detail

By P. D. MANBECK
Research Laboratories, National Carbon Company, Cleveland

THE application of carbon brushes to motors and generators has undergone a remarkable change in the past few years. The old abrasive brushes designed for machines with hard flush mica are being very rapidly displaced by the electrographitic non-abrasive type adapted to the present-day machines, most of which have slotted commutators. The results secured with the latter type of brush are far superior to those from the old carbon brush. In the first place, the carrying capacity is much greater, thus giving the brush the ability to withstand surges and shorts with very little sparking. In the second place, the high contact drop of the electrographitic brush gives it a desirable inherent commutating characteristic that no other type of brush possesses. Thirdly, it is non-abrasive, so that its coefficient of friction is low, thus insuring long life to the commutator.



FIGS. 1 TO 4—OSCILLOGRAMS SHOWING EXTENT OF POSITIVE AND NEGATIVE VOLTAGE DROPS CHARACTERISTIC OF DIFFERENT GRADES OF BRUSHES, ALSO THE EFFECT ON BRUSHES OF IRREGULARITIES ON COMMUTATOR SURFACES

Distinction Between Abrasiveness and Hardness

Abrasiveness and hardness are so often confused that it might be well to differentiate between them here. A brush may be very hard and non-abrasive at the same time; on the other hand, a very soft graphite brush may be very abrasive and cut the commutator. The materials in the brush and the method of baking determine the degree of abrasiveness and not the hardness. A brush baked to a low temperature will be slightly abrasive regardless of the materials used, whereas a graphitized brush is nearly always non-abrasive or only slightly polishing. An abrasive brush should be used only on flush mica commutators or on machines with slotted commutators that are subject to heavy loads suddenly applied. Reversing mill motors, table roll motors and crane motors are in the latter class. A non-abrasive brush should be used preferably on slotted commutators, but may be operated on flush commutators, provided the machine is not subject to severe service that would cause the brush to spark. Sparking burns the copper away, thus leaving the mica high and causing rapid brush wear.

A sales engineer is sometimes in more or less of a quandary when it comes to recommending a brush for a flush mica machine, because of the uncertainty as to the quality of mica in the commutator. Many a brush has been wrecked because of hard flush mica. The uncertainty arises from the fact that some grades of mica are harder than others, thus requiring a more abrasive brush to keep the mica flush with the copper. Equally as important to the brush as the quality of mica is the kind of service required of the machine. If the loads are heavy and suddenly applied, a more abrasive brush is needed to keep the commutator clean. If, however, the commutator is slotted, a non-abrasive brush is almost always chosen, because no cutting action is necessary.

Probably more important than abrasiveness is the

property of the brush known as the contact drop. It has been found that a brush possessing a relatively high contact drop produces better commutation than a low contact drop brush. This is because the short-circuit currents in the face of the brush during the commutating period are thereby held to a reasonable value, thus reducing the I^2R heat loss at this point. There is a common fallacy among many electricians that a high-resistance brush is necessarily a high contact drop brush. This is not so. A brush having a very low internal or specific resistance may have at the same time a high contact drop. It is essential to choose a brush which has the right value of drop for the service where it is to be placed. As a usual rule, brushes of high contact drop operate more satisfactorily from 110 volts to 600 volts than brushes of relatively low contact drop. However, this is by no means a general rule, because the later types of machines having interpoles are so designed that the interpoles aid the contact drop of the brush in producing good commutation. Some brushes must be aided more than others in this respect—in fact, some brushes have the peculiar property of having a lower negative than positive contact drop. This is a very bad characteristic since interpole compensation is equal for positive and negative poles. If brushes of this character are used on machines in a three-wire Edison system, there is likely to be an excessive circulating current in the neutral connection between machines due to this fact. Fig. 1 shows an oscillogram of the positive and negative contact drops of a brush having the characteristic mentioned above. Nearly all grades of brushes show some difference between positive and negative drops, and it is very seldom that one encounters a grade of brush that has an equal positive and negative contact drop. Fig. 2 shows an oscillogram of the positive and negative drops of such a brush. The positive and negative contact drop are equal with this grade of brush and no danger of unbalance in encountered. The necessity of delicate adjustment of machines is eliminated and the factor of safety thereby increased.

The oscillograms also demonstrate the effect of the irregularities on the surface of the commutator, emphasizing the necessity of keeping the commutator

Brush Applications Classified

Alternating Current—Collector Ring Service.—This class of service is one of the hardest for which to recommend a satisfactory brush. The difficulty arises with the metal graphite brushes for 60-cycle rotary converters where the high speed combined with high current density tends to disintegrate the brushes and cut the rings. The best quality brush is none too expensive for this service. On 25-cycle rotaries of the older design the ordinary metal graphite brush may be used with perfect satisfaction and in some cases an electrographitic brush of high carrying capacity. Railway rotaries of 500 to 1,000-kw. capacity subject to intermittent loads come under the latter classification.

The other classes of service coming under this heading are synchronous motor rings and induction motor rings. An electrographitic or graphite brush is used for the lower current densities and metal graphite for the higher densities. The dividing point has been placed at approximately 75 amp. per square inch. The electrographitic brush will last longer than the metal graphite brush, but the heat generated at the contact will be greater on account of the high contact drop of the former. This is partly compensated for by difference in coefficient of friction between the two grades of brushes.

Alternating Current Commutating Type Motors.—A considerable number of alternating-current commutator motors have rather poor commutating characteristics, and it cannot be expected that a brush will have as long a life in this service as in direct-current commutator service. Small high-speed universal motors operating on alternating current come under this classification and require a high contact drop brush to reduce the circulating current as much as possible. Slotting improves the life of the brushes considerably on these small jobs. If it is thought desirable to operate with flush mica, a slightly abrasive brush having as high a contact drop as is possible to get should be used.

If the brushes are used on single-phase motors during the starting period only, some sparking will occur. For this reason a slightly abrasive graphite carbon brush is required in order to insure a clean commutator. If the brushes remain in contact with the commutator continually, a partly or fully graphitized brush can be used, depending on whether the commutator is flush or slotted.

The hardest service in this class is encountered with polyphase power motors because of the high current densities involved. These motors are used for specialized service only, and the question of brushes should be referred to the brush manufacturer for recommendation.

Direct Current—Low Voltage Up to 80 Volts.—There are some plating generators with voltages of 3 and below, but they are exceptional. Most generators of this type are of the 6 to 12-volt class and require a metal graphite brush of low contact drop and low coefficient of friction. Metal graphite brushes meant for low-voltage commutator service are rated more conservatively than they are for slip-ring service because the short-circuit currents are added to the load current through the face of the brush and must be allowed for. Brush pressures must be equalized on all brush studs in order to prevent local heating due to the selective action of the current.

Medium-voltage battery-charging generators, farm-lighting generators and motors of 32 to 40 volts are usually very good commutating machines and will operate satisfactorily with a graphite-carbon brush of medium contact drop.

Vehicle and industrial truck motors of 20 to 25 volts must have a metal graphite brush of relatively low contact drop. Brushes designed for this service generally have from 10 to 20 per cent of graphite in their composition for lubricating purposes.

Above 25 volts and below 42 volts a very low metal content brush can be used, and above 42 volts a graphite or graphitized brush will give satisfactory service. The best operating brush for this class of machines from a commutating standpoint will be found to be the brush with the least metal in its composition that will not heat excessively under full load due to having too high a contact drop.

Mine locomotive motors require a tough grade of brush having a relatively abrasive characteristic. They are roughly handled and many times heavily overloaded. If the commutators are slotted, a semi-electrographitic brush can be used. If some attention is given to cleaning the motor occasionally and the slots are kept clean the latter type of brush will give better service both from the standpoint of commutation and wear on the commutator.

Direct Current—Standard Voltage (80-750 Volts).—As a rule, the commutating characteristics of small direct-current machines such as are designed for operating grinders, polishing wheels, fans, electric drills and vacuum cleaners are good enough for an ordinary graphite-carbon brush to be used if the mica is flush and a good grade of electrographitic brush if the commutator is slotted. Special cases where low friction brushes are required or very quiet operation is essential should be taken up with the brush manufacturer. Small household refrigeration units come under the latter classification.

Practically all sizes of power ap-

Brush Applications Classified (Continued)

paratus, whether of motors, generators or rotary converters, can be divided into three groups according to speed. The first group includes the older type of machines operating at 1,500 ft. per minute or under. Much of this apparatus is still operating with flush mica, and since the current density is usually rather low, a relatively cheap grade of carbon can be used, and in many cases a lubricated grade of abrasive carbon gives better service than the more recently developed high-quality brushes.

The medium-speed machines operate very well with a good grade of graphite carbon on flush mica and a hard grade of electrographitic carbon if the mica is undercut. The speed of machines in this class is between 1,500 and 3,500 ft. per minute.

Above 3,500 ft. per minute slotting is strongly recommended and the highest grade of electrographitic brush is required. In some cases where very high current densities are normal (80 amp. per square inch) a high carrying capacity graphite brush is used. Brushes in operation on high-speed machines do not show the long life that the old type of carbon brush showed on the liberally designed slow-speed machines. Both speed and current density have been increased in the past few years, with the result that brushes wear away faster than formerly due to the disintegrating action of the current.

Motors designed for crane, elevator or steel mill service usually require a brush having some polishing action, even though the commutators are slotted. The frequent starting and stopping (dynamic braking) have a tendency to oxidize the commutator and consequently a brush possessing some abrasive action is necessary for this application. High carrying capacity is not so essential as toughness and abrasiveness.

Ventilating fan motors and centrifugal pump motors are usually not as severe on brushes as steel-mill motors and can therefore be operated with partly graphitized brushes, which have better commutating characteristics.

Power motors in mines are sometimes difficult to fit with brushes, because of the peculiar conditions under which the motors have to operate. A slightly abrasive graphite carbon brush is usually satisfactory, but in certain cases where the mine water seems to have a hardening effect on the commutator a soft graphite brush will operate best. This same recommendation will hold true if a great deal of very sharp abrasive material is flying in the air near where the motors are located. The soft graphitic material of the brush will not have the tendency to hold the abrasive material against the commutator in the same manner in which a harder grade does.

Specialized Service.—There are several classes of service that are not mentioned in any of the above and only a very general statement in regard to them will be made here. Car-lighting generators of the axle type are very similar to stationary battery-charging generators in their characteristics, and the same recommendations apply. A good grade of electrographitic brush of medium-contact drop is usually found satisfactory in this service.

Railway switch and signal motors are divided into two classes according to voltage. The lower-voltage machines require a heavy metal graphite brush to produce the requisite starting torque, whereas standard voltage machines of 110 volts perform best if a medium abrasive brush is used on account of the tendency to oxidize the commutator due to the frequent starting and stopping.

Welding generators are subject to great fluctuations in load and for that reason must have a reactance in series with the arc. This helps the brush hold down the rush of current as the circuit is completed. It is imperative that a brush having a very high contact drop be used for this service in order to aid the interpole winding to reverse the current in the coil under commutation.

Motion picture arc generators also require a brush having a high contact drop in order to lend a stabilizing influence to the current in the arc circuit. Commutation under normal running conditions is also greatly improved by the use of a high contact drop brush. In the case of welding generators and motion picture arc generators, it is essential that the commutators be slotted for satisfactory operation.

Railway Motor Applications.—Application of carbon brushes to motors in the railway field is a subject to which an entire article might be devoted and is not discussed here because of the specialized field to which the remarks would appeal.

true and free from grit. Any foreign substance on the commutator lifts the brush out of contact momentarily, thus causing it to spark and burn. Fig. 3 shows the effect of a slight flat spot on the commutator. There are a number of peaks in the contact drop curve which might cause very severe sparking, bad burning of the commutator and rapid wear of the brushes. It is a prime necessity for good brush operation to keep flat spots out of the commutator and the machine free from vibration.

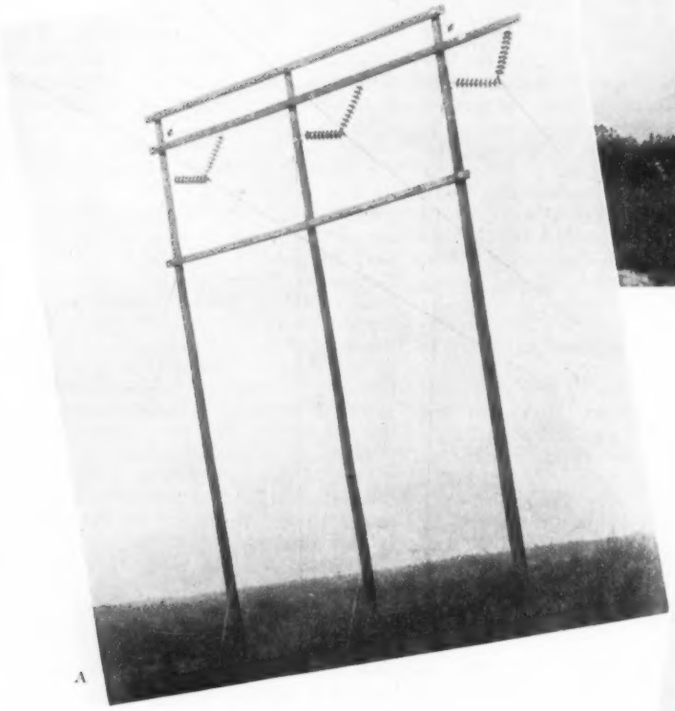
Importance of Brush Pressure

Brush pressure is another very important operating variable that is frequently neglected. Tests have conclusively shown that the contact drop of the brush, the property of which largely determines its commutating characteristics, is very intimately connected with the brush pressure. Fig. 4 shows this effect in a very striking manner. The upper curve represents the contact drop of an electrographitic grade of brush under a pressure of 2 lb. per square inch, the center curve the same thing at 4 lb. per square inch and the lower curve at 8 lb. per square inch. This corresponds to contact drops of 2.53 volts, 1.75 volts and 1.09 volts respectively. Thus it will be seen that the drop is in the reverse ratio of the brush pressure. This fact will explain the selective action that sometimes occurs, particularly on machines designed for high current density in the brushes. The additional load the brushes have to carry due to the increased current resulting from unequal spring tension may be sufficient to cause the brushes to glow, burn the commutator and oxidize the shunts.

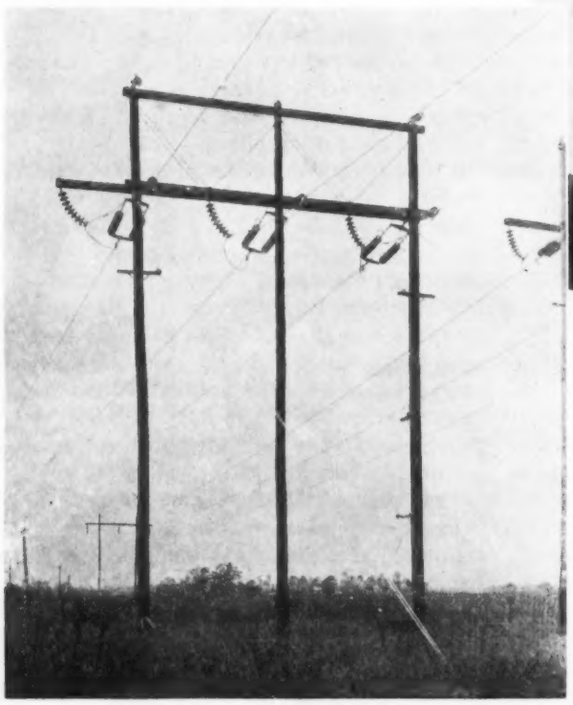
On account of the great number of variables involved in the operation of carbon brushes on electrical machines, it is not an easy matter to make definite recommendations for specific classes of service, especially if the operating conditions are unknown. However, general recommendations can be suggested that will give some idea of the kind of brush that has given the best service for a given application and that may guide in a selection of brushes. In the recommendations that follow the term "electrographitic" is used to designate a carbon brush that has been baked in the electric furnace to a high temperature. Depending on the electrical power input and the rate at which it is applied, the "electrographitic" brushes will be partly or fully graphitized. The fully graphitized brushes are the highest quality brushes of the "electrographitic" series.

The "metal graphite" brushes are those brushes that contain a metal as well as carbon or graphite in their composition. The most common metal used in these brushes is copper, although some contain small quantities of tin and lead as well. The "metal graphite" brushes will carry more current than the carbon or graphite grades because of their lower resistance and lower contact drop.

Four Types of Line Support Used on Alabama-Mississippi Tie Line



A



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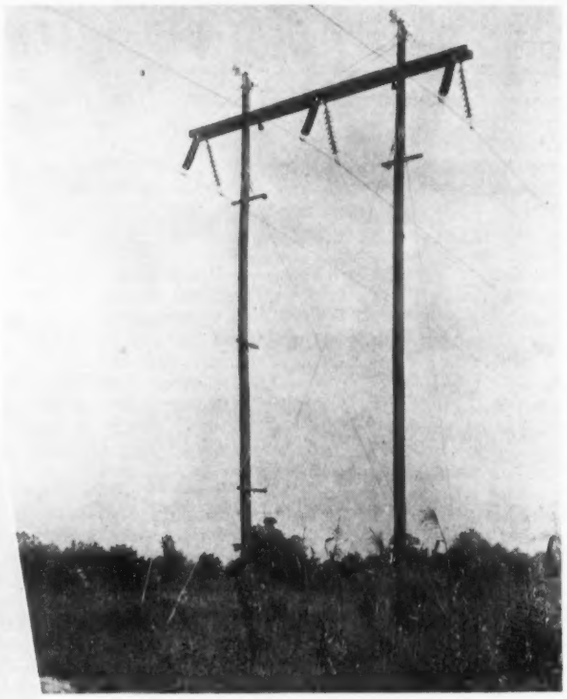

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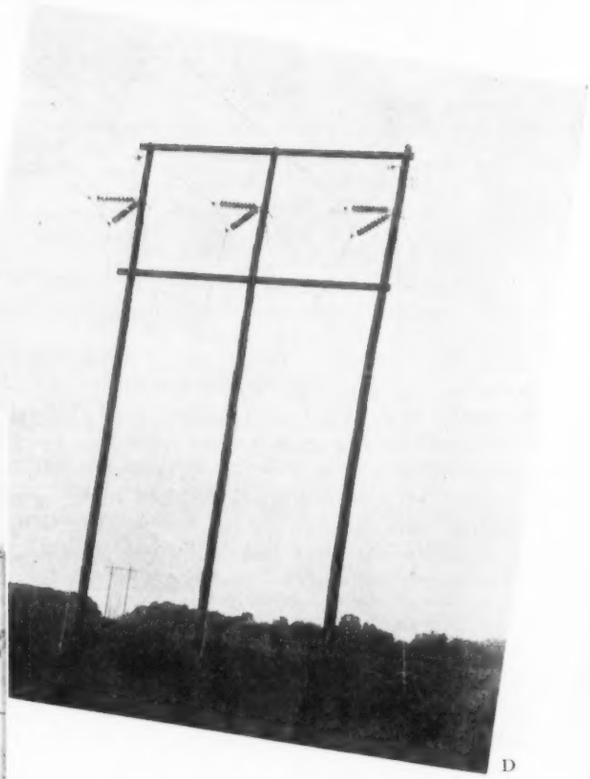


D

SEVERAL types of wood-pole structures are used on the 110-kv. tie-line between Lock 18, near Wetumpka, Ala., and Hattiesburg, Miss., four of which are illustrated here. The other types, with some details of construction, are shown on accompanying pages. A shows a suspension pull-off structure (type E); B is a substation dead-end structure (type I); C is a double-arm semi-anchor structure (type C); D is a semi-anchor pull-off angle structure (type G).

110-Kv. Wood-Pole Transmission Line

Construction Details of Lock 18-Hattiesburg 110-Kv. Line of the Alabama Power Company and the Mississippi Power Company

By J. P. LEWIS

Transmission Line Engineer Alabama Power Company, Birmingham, Ala.

THE main tie line between the Alabama Power Company and the Mississippi Power Company that was placed in operation last April is approximately 231 miles in length. This line from Lock 18, the Alabama company's new hydro project near Wetumpka, to Cuba, Ala., a distance of 131 miles, is part of the Alabama Power Company's system, whereas the line from Cuba to Hattiesburg, Miss., a distance of 99 miles, is part of the Mississippi Power Company's system. Both of these companies are subsidiaries of the Southeastern Power & Light Company.

In addition to supplying primary power to the Alabama Power Company substations at Selma, Demopolis and Cuba, the line enables the Mississippi Power Company to shut down the steam plants at Meridian, Laurel and Hattiesburg, Miss. The entire line was designed and constructed by the Dixie Construction Company, the engineering and construction organization of the Alabama Power Company.

Support Structure Design

The design of the line was largely influenced by the assumed fact that it is in the light-loading zone (no ice and 12-lb. wind). It was considered permissible to increase the span lengths above spans normally used, by increasing the height of support structures. A careful study of the mechanical loading and cost per mile of line with structure of various heights and various span lengths indicated that a 65-ft. "H" frame structure with normal span of 915 ft. would be the most economical and most satisfactory from the construction standpoint.

An "H" frame structure consisting of two 65-ft. creosoted pine poles with 8-in. top and one 6-in. x 8-in. x 30-ft. creosoted pine crossarm was adopted as the standard straight-line suspension structure. This is shown in Fig. 1. The crossarms are braced with airplane type bracing or tension rods.

This structure is so designed that the vertical loading on the crossarm at the points of conductor support is partly balanced, thus decreasing the tendency of the crossarm to bow. Tension rods shown in Fig. 2 were used to tie the pole tops to the points of conductor support and serve the triple purpose of supporting the crossarm, bracing the structure against transverse loads and facilitating the grounding of insulator hardware

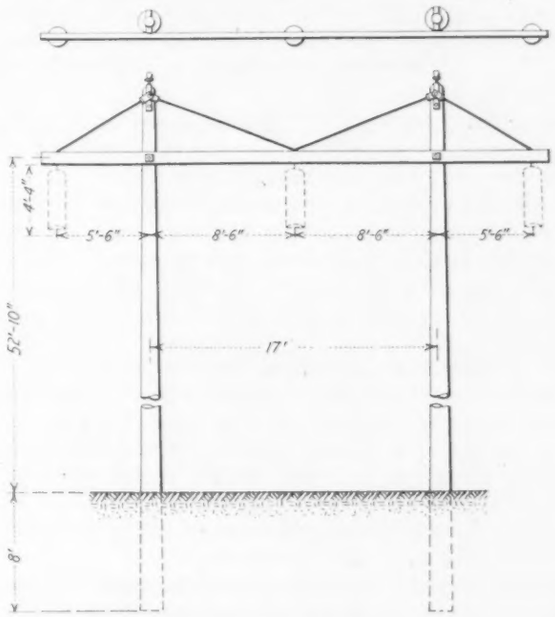


FIG. 1—STANDARD STRAIGHT-LINE SUSPENSION STRUCTURE

to the pole grounds. The insulator hardware was grounded in order to secure a more positive operation of circuit breaker relays on the line. The pole grounds shown in Fig. 3 consisted of No. 4 hard-drawn bare solid copper, stapled the length of the pole with eighteen turns around the butt and a spiral of six turns on the butt end.

To avoid cutting raw gains in the field, the opposite

TABLE I—GENERAL CHARACTERISTICS OF LOCK 18, HATTIESBURG LINE

Length, miles	230.7
Number of circuits	1
Frequency, cycles	60
Voltage between phases	110,000
Voltage from phase to ground	63,586
Insulation to ground, 60-cycle dry-flashover, volts	415,000
Right-of-way, 100 ft., secured mostly by easements, 60 ft. cleared and dangerous timber cut.	
Structures, 60-ft. creosote pine hole "H" frame.	
Normal height of conductor above ground at structure	48 ft. 2 in.
Normal span, ft.	915
Average span, ft.	918
Maximum span, ft.	1,931
Assumed maximum loading: No ice, 12-lb. wind pressure and 0 deg. F.	

TABLE II—TYPES OF WOOD-POLE STRUCTURES

Type A	Standard suspension structure for straight line and angles to 1½ deg.
Type B	Double-arm single-suspension structure for long spans and highway crossings.
Type C	Double-arm semi-anchor structure for small angles and railroad crossings.
Type D	Tie-down structure for small angles (superseded).
Type E	Suspension pull-off angle structure for small angles (supersedes tie-down structure).
Type F	Single-string pull-off structure for medium angles.
Type G	Semi-anchor pull-off structure for large angles.
Type H	Strain structure for sectionalizing switch.
Type I	Dead-end structure.

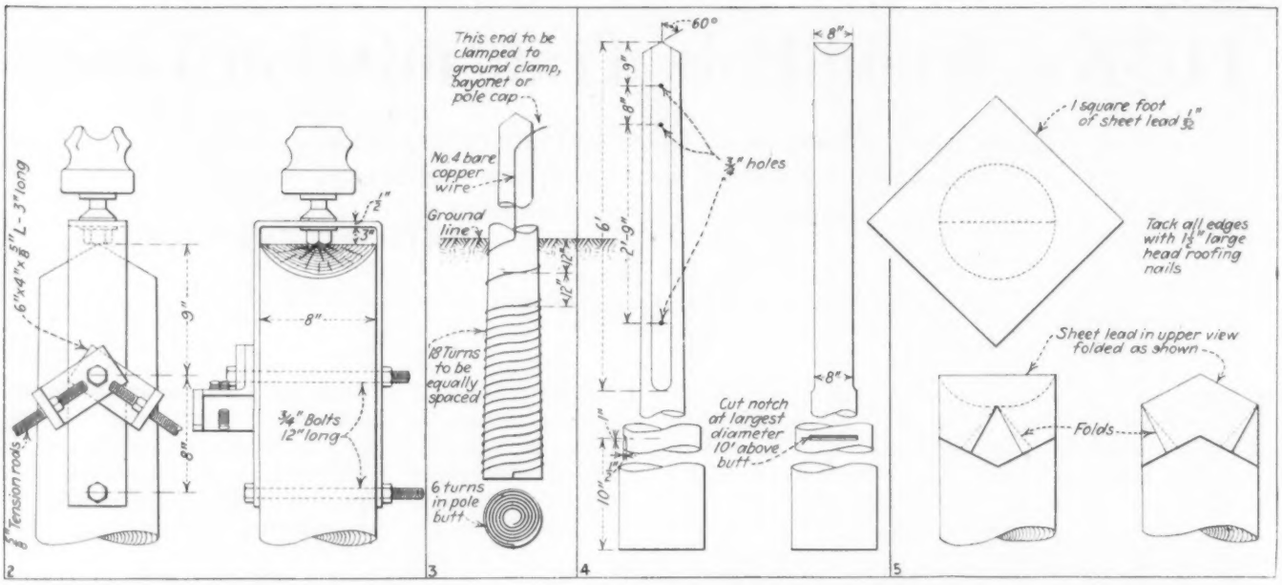


FIG. 2—METHOD OF INSULATING OVERHEAD CONTROL WIRES AND ATTACHING TENSION RODS TO POLE TOPS. FIG. 3—HOW POLE GROUNDS ARE ATTACHED. FIG. 4—STANDARD POLE GAINING. FIG. 5—LEAD CAP POLE ROOFING

sides of the poles were flattened as shown in Fig. 4 before creosoting. This was done for a distance of 6 ft. from the top. This flattened surface offers good bearing for the crossarms and necessitates the boring in the field of only one through bolt hole. As a further precaution against pole decay, due to season checks in the pole top allowing moisture to enter, all of the poles were roofed as shown in Fig. 5 with a 1/32-in. sheet lead cap.

To increase the mechanical stability of the line and compensate for the reduced stability due to the height of support structures and length of spans, the poles were set to a depth of 8 ft., every other structure side guyed and one structure per mile double armed and storm guyed. Hardwood slugs 10 in. in diameter and 8 ft. long were used for head guy anchors and a special concrete slug was designed for side guys.

The structures were designed to carry two ½-in. Siemens-Martin overhead wires attached to the pole tops as shown in Fig. 2 and insulated for 23,000 volts. These overhead wires were insulated for a threefold purpose—namely, carrier current communication between primary substations, supervisory control operation of automatic sectionalizing switches and audio communication for emergency patrol with line out of service. The overhead wires were also assumed to offer partial static ground wire protection by being grounded, every twelve or fifteen miles, through spark gaps.

MAINTENANCE FEATURES OF STRUCTURE DESIGN

Due to the length of the line and the importance of continuity of service, the design was influenced by the necessity for live line maintenance. In order to eliminate strain structures which are difficult to work when the line is energized, all angles where possible were turned on tie-down or pull-off structure. The tie-down structure for small angles was superseded by the suspension pull-off structure, in view of the difficulty of adequately guying the former structure. Dead-end structures were reduced to an absolute minimum, and to facilitate working the dead ends with the line in service a special double strain yoke, shown in Fig. 8, was designed. This yoke permits of a third maintenance insulator string being inserted in the middle of the yoke and the tension taken up on this string by means of a turnbuckle, whereas the tension on the two permanent strings is released by means of turnbuckles, thus permitting these insulator strings to be removed for the purpose of replacing defective units.

CONDUCTOR INSULATION

The possibility of line interruptions due to insulator units becoming defective was reduced by the use of eight 10-in. standard strength suspension units in suspension, nine units on pull-off and semi-anchors and nine units double yoked on strains and dead ends. The majority of the insulators used were Lock No. 5,800 clevis type units, but for the purpose of securing operating data, four ten-mile adjacent sections were each equipped with Ohio Brass, Locke, Lapp and Westinghouse standard strength 10-in. suspension units.

The overhead supervisory control conductors were insulated with Ohio Brass No. 12,852 pin-type insulators on straight-line structures, and one Lapp No. 2,049

TABLE III—DESIGN DATA FOR WOOD-POLE STRUCTURE

Poles: 65-ft., 8-in. top dense Southern pine treated with 10-lb. open cell treatment No. 1 A.R.E.A. oil.
Crossarms: 6-in. x 8-in. x 30-ft. dense Southern pine treated with 10-lb. open cell treatment No. 1 A.R.E.A. oil.

Pole spacing center to center, ft	17
Conductor spacing, ft	14
Minimum electrical clearance.	
Live part to structure normal, ft	5
Live part to structure maximum swing, ft	3
Across insulator gap, ft	4
Standard height ground line to crossarm	52 ft. 6 in
Type of guys.	
Side guys	Concrete 18 in. diameter
Head guys	Hardwood slug 10 in. diameter, 8 ft. long
Guy wire, head guys	¼-in. Siemens-Martin seven strand
side guys	¼-in. Siemens-Martin seven strand

Type of structures	A	B	C	D	E	F	G	H	I	Spec.
Number used	1,063	135	32	24	23	32	18	11	18	8
Maximum allowable span, ft.	1,200	1,400	1,600	1,200	1,600	1,200	1,600	1,200	1,600	2,000
Maximum allowable angle, deg.	1½	1½	3½	10	10	20	45	15	45	90
Number of guys (straight line)	2	2	6	—	—	—	—	6	6	Spec.
Number of guys (on angles)	1	2	2	3	9	10	11	8	8	Spec.

TABLE IV—CONDUCTORS FOR 110-KV. LINE

	397,500 Circ.mil A.C.S.R.	No. 4/0 A.C.S.R.	No. 1/0 Composition A.C.S.R.	½-in. Siemens-Martin
Number of aluminum strands	26	6	3	—
Number of steel strands	7	1	4	7
Per cent aluminum	70	67.6	26.3	—
Copper equivalent of aluminum	250,000	No. 2/0	No. 5	—
Over-all diameter, in.	0.771	0.564	0.398	0.5
Weight per foot, lb.	0.5326	0.295	0.240	0.517
Listed elastic limit, lb.	10,430	5940	7760	6050
Listed ultimate strength, lb.	14,960	8435	9830	12,100
Tension at assumed maximum load, lb.	5,215	3200	3300	5500

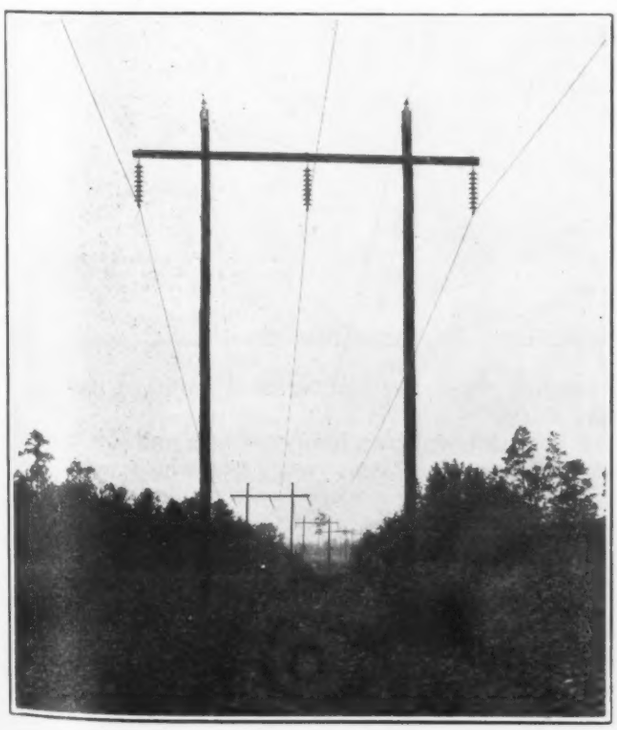
Overhead ground clearance, 25 ft. at maximum load.

high-strength unit on angles, transpositions and dead ends.

From Lock 18 to Meridian, a distance of 149 miles, the conductor is 397,500 circ.mil A.C.S.R. (30 per cent steel), and from Meridian to Hattiesburg, a distance of 82 miles, the conductor is No. 4/0 A.C.S.R. By taking advantage of the light loading on the line and using 30 per cent steel 397,500 circ.mil A.C.S.R. instead of 40 per cent steel a saving of approximately 8 per cent was effected in cost of conductors.

Supervisory Control Conductors

The original line design included two ½-in. Siemens-Martin steel strand overhead ground wires, but the structure design was later modified to permit of insulating the overhead ground wires for supervisory switch control and carrier current communication. In view of the fact that the manufacturer of the carrier current apparatus stated that calculations indicated that the apparatus would not satisfactorily transmit, with ½-in. steel strand as a conductor, over a distance greater than 50 miles, a special composition aluminum steel conductor was designed and installed for experimental purposes on a 50-mile section of the line. This special conductor consists of three strands of 0.1327 diameter aluminum and four strands of 0.1327 steel and is equivalent in diameter to No. 1/0 A.C.S.R. with an ultimate strength of 80 per cent of ½-in. Siemens-Martin steel strand.



STRAIGHT-LINE SUSPENSION STRUCTURE, TYPE A

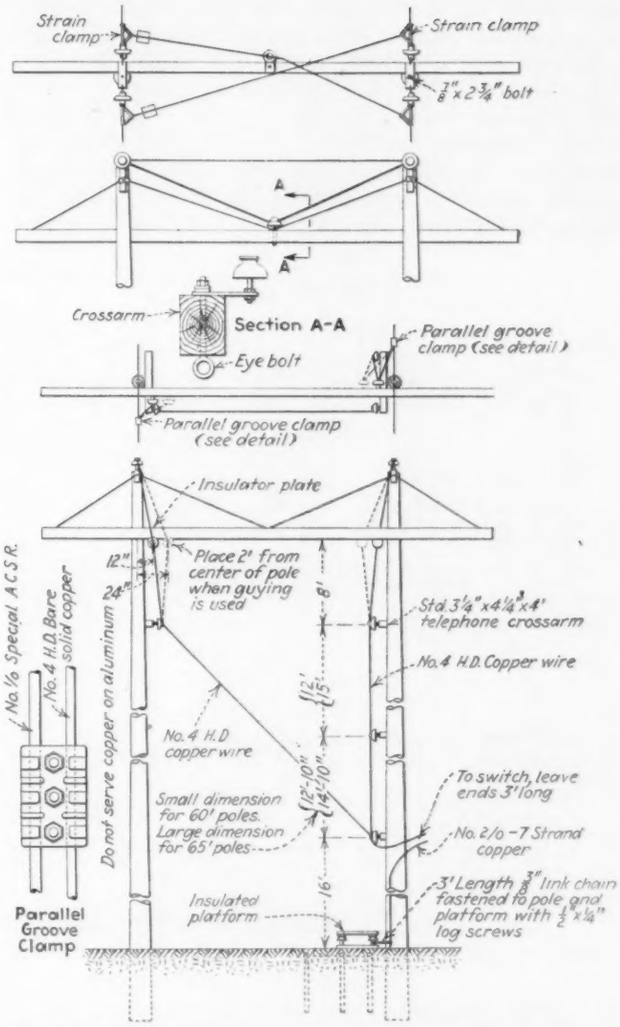

Strain clamp
Strain clamp
⅞" x 2¾" bolt
A
A
Crossarm
Section A-A
Eye bolt
Parallel groove clamp (see detail)
Parallel groove clamp (see detail)
Insulator plate
12"
24"
Place 2' from center of pole when guying is used
8'
Std 3¼" x 4¼" x 4' telephone crossarm
No. 4 H.D. Copper wire
No. 4 H.D copper wire
No. 4 H.D. Bare solid copper
No. 4 Special A.C.S.R.
Do not serve copper on aluminum
12'-10"
14'-10"
Small dimension for 60' poles. Large dimension for 65' poles
To switch, leave ends 3' long
No. 2/0 - 7 Strand copper
3' Length ⅜" link chain fastened to pole and platform with ½" x ¼" lag screws
16'
Insulated platform
Parallel Groove Clamp

FIG. 6 (TOP)—METHOD OF TRANSPOSING OVERHEAD CONTROL WIRES. FIG. 7 (BOTTOM)—CONNECTION TO OVERHEAD CONTROL WIRES FOR PATROLMAN AUDIO COMMUNICATION

With the view toward providing carrier current communication between the primary substations on the line, should the ½-in. Siemens-Martin conductor prove entirely unsatisfactory, carrier current-coupling antennas were installed at each primary substation in order that the power conductors could be used for carrier current communication.

Line Sectionalizing Facilities

To minimize the length of interruptions and facilitate the locating of trouble on the line, automatic supervisory control-operated sectionalizing switches, shown in Fig. 9, were installed approximately every fifteen miles. By means of these switches it is possible to determine quickly in which fifteen-mile section the trouble is located and concentrate patrolmen and maintenance crews in this section. As a further aid in locating and clearing up line trouble, connections to the overhead supervisory control conductors, shown in Fig. 7, were made every two miles for patrolman audio communication.

Because the line crosses many small streams and swamps that are impassable during the wet season, it was necessary to provide some means of patroling the

line without the patrolmen making long detours around the impassable points. Consequently two types of cable walkways were designed, a two-wire cableway and a cable walkway. The two-wire cableway consists of two steel messenger cables strung on 20-ft. creosote poles. The patrolman crosses by sliding his feet along the lower cable and holding on to the top cable. These were installed where the stream or swamp is impassable for short periods of the year only. The cable walkway consists of a suspension latticed footwalk with hand rail cables strung on 20-ft. creosote poles. These were installed across streams and swamps that are impassable during practically the entire year.

All poles, crossarms, wire and insulators were distributed by hauling camps. These major materials were shipped direct from manufacturers to railroad sidings near the line, from which point the material was hauled on motor trucks along the main roads to the nearest accessible points to the line. The material was next loaded on four-mule drays and distributed along the right-of-way to the line structure stations. In order to keep sufficient material distributed to avoid holding up the line crews, the hauling camps worked day and night shifts.

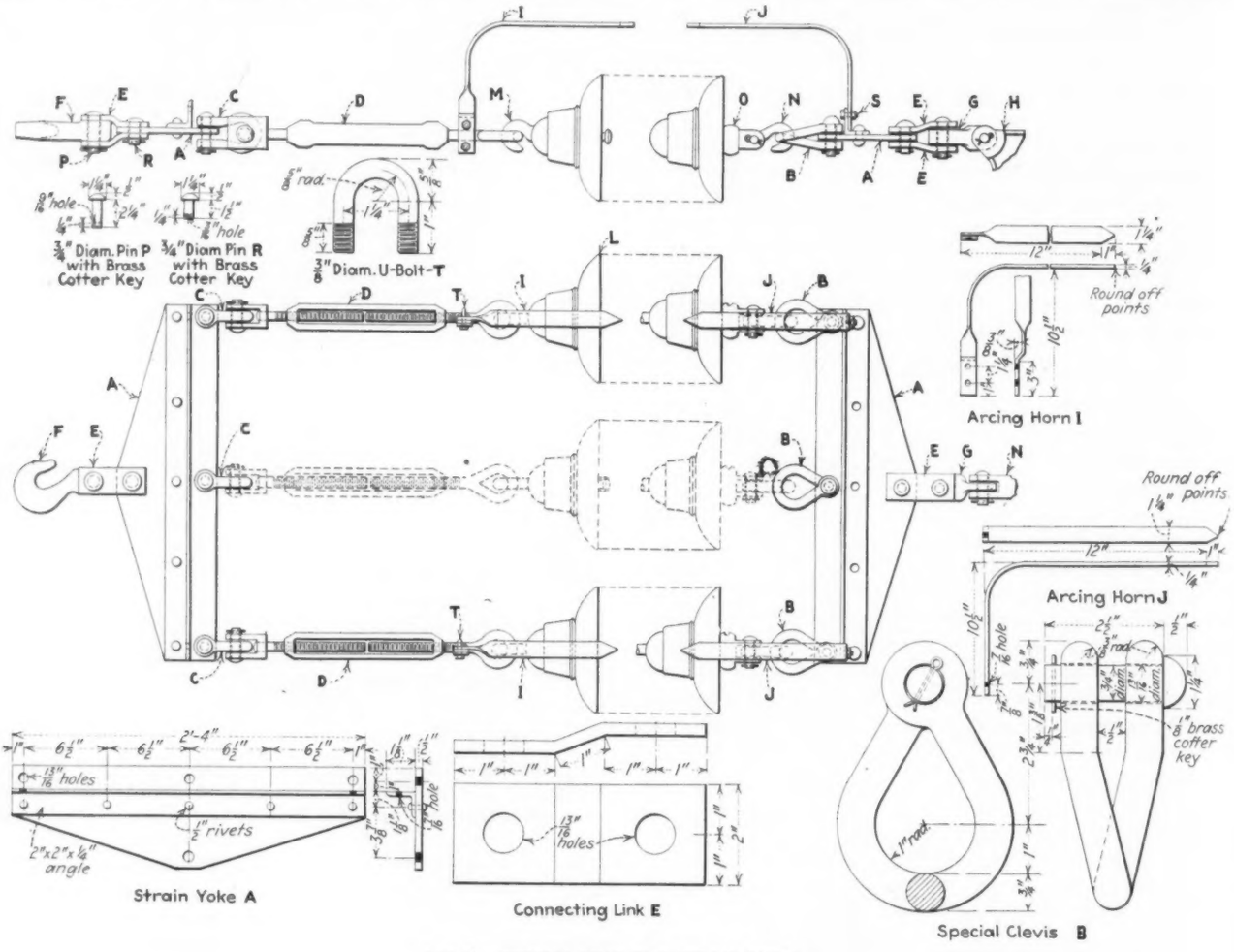

Strain Yoke A
Connecting Link E
Special Clevis B
Arcing Horn I
Arcing Horn J
Round off points
¾" Diam. Pin P with Brass Cotter Key
¾" Diam Pin R with Brass Cotter Key
⅜" Diam. U-Bolt-T
⅛" brass cotter key

FIG. 8—SPECIAL DEAD-END STRAIN YOKE

Mark	No. Req'd.	Bill of Material Description
A	2	Strain yokes
B	3	Special clevises and pins
C	3	Strain clevises
D	3	Turnbuckles, ¾ in. x 12 in. with eyes and clevis
E	4	Connecting links
F	1	Strain hook
G	1	Right angle adapter
H	1	Strain clamp
I	2	Arcing horns
J	2	Arcing horns
L	18	Suspension insulators
M	2	Insulator hooks
N	2	Insulator hooks
O	0	Ball socket clevises
P	2	¾-in. x 2¼-in. pin and cotter key
R	2	¾-in. x 1½-in. pin and cotter key
S	2	⅝-in. x 1-in. machine bolt—hexagonal nut
T	2	⅝-in. U-bolt hexagonal nuts

All insulator and pole hardware was shipped to the central distributing warehouse, from which point the material required for a section of six miles of line was hauled to the line camps for distribution as required by the progress of the work.

In view of the abundance of local labor in the vicinity of the line, practically all right-of-way was cleared with this local labor instead of with the usual clearing camps. The laborers boarded themselves and were collected each morning and transported to the job in light trucks. An appreciable saving in cost of right-of-way clearing was effected by this method of clearing.

FIELD CONSTRUCTION ORGANIZATION

The line was constructed by two division field organizations operating as separate units, each under the supervision of a division foreman. Each division embraced a central warehouse for small materials and equipment, a division office for field clerical force, three standard 40 to 50-men line camps and three floating or boarding crews. Approximately 200 men were employed in each division.

All concrete side anchors were installed in advance of any other construction by anchor-setting crews, specially trained for this work. These crews, consisting of sixteen men with a ¾-ton truck, boarded in towns adjacent to the line and hauled the necessary sand, cement and water in the truck used for transporting the crew. All concrete anchors were tested for a pull of 3,000 lb. before the guys were hung. The concrete slug anchors proved very satisfactory for light side guying and are more economical to install than hardwood slug anchors.

Due to the difficulty of excavating pole holes to a depth of 8 ft. with standard digging tools, all pole holes were excavated to a depth of 3½ ft. and then shot with dynamite. A 2-in. hole was bored in the center of the pole hole to a depth of 7½ ft. and three sticks of dynamite were inserted in the hole with a 12-in. separator between the sticks. After shooting, the holes

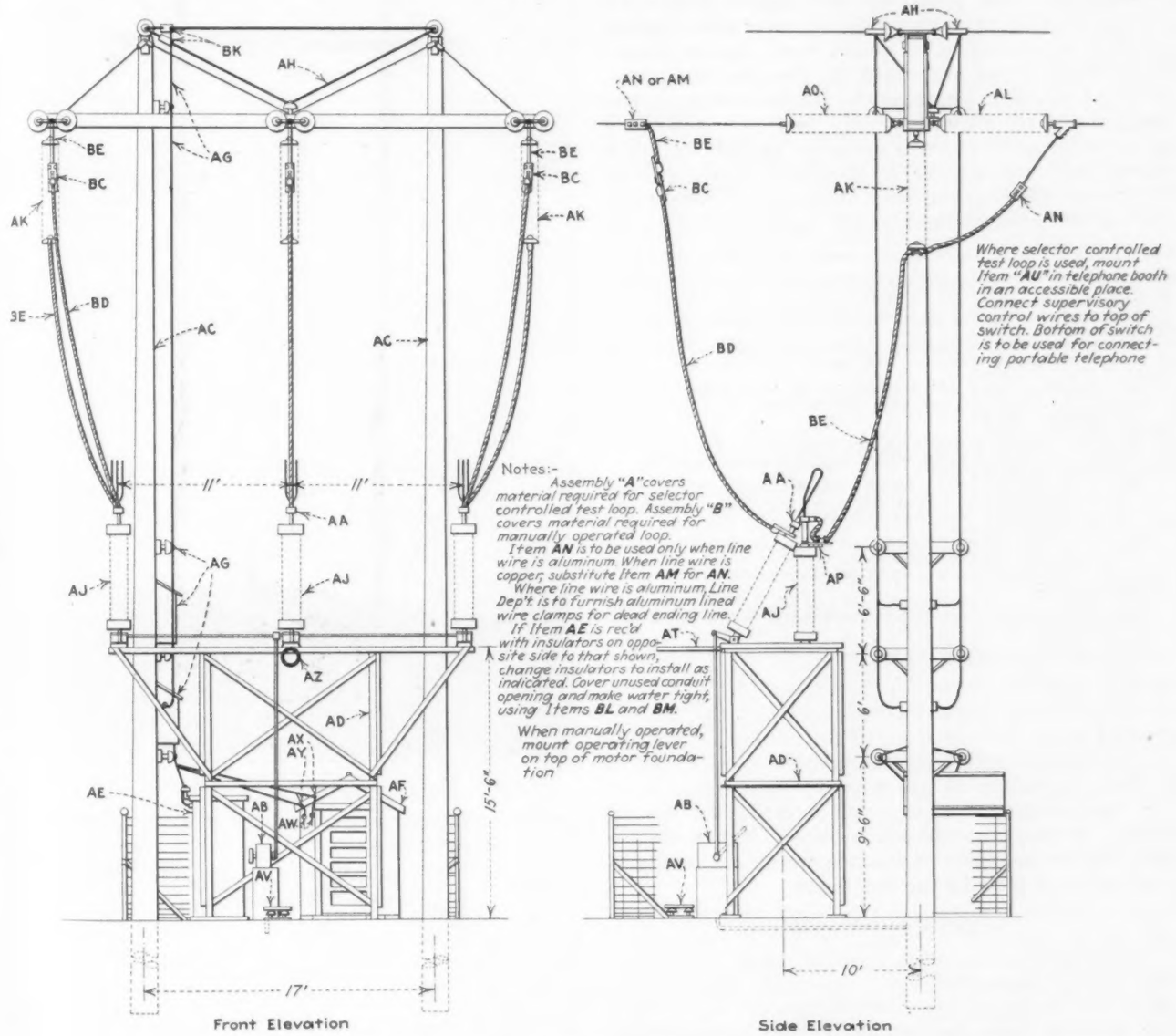

BK
AH
BE
AG
BC
AK
BD
AC
11'
AA
AJ
AZ
AD
AX
AY
AE
AB
AW
AF
AV
15'-6"
17'
Front Elevation
AN or AM
AO
AL
AU
Where selector controlled test loop is used, mount Item "AU" in telephone booth in an accessible place. Connect supervisory control wires to top of switch. Bottom of switch is to be used for connecting portable telephone
AP
AT
9'-6"
10'
Side Elevation
Notes:-
Assembly "A" covers material required for selector controlled test loop. Assembly "B" covers material required for manually operated loop.
Item AN is to be used only when line wire is aluminum. When line wire is copper, substitute Item AM for AN.
Where line wire is aluminum, Line Dep't is to furnish aluminum lined wire clamps for dead ending line.
If Item AE is rec'd with insulators on opposite side to that shown, change insulators to install as indicated. Cover unused conduit opening and make water tight, using Items BL and BM.
When manually operated, mount operating lever on top of motor foundation

FIG. 9—SELECTOR-CONTROLLED AUTOMATIC SECTIONALIZING SWITCH STRUCTURE (TYPE H)

Assembly "B" No. Required	Mark	Assembly "A" No. Required	Description
1	AA	1	Air break switch, 110 kv., 400 amp.
	AB	1	Motor-operated mechanism
1	AC	1	Test loop structure
1	AD	1	Structure for automatic sectionalizing switch
	AE	1	Steel switch house
1	AF	1	Patrolman's telephone booth
	AG	1	Outdoor protective equipment
	AH	1	Standard transposition
6	AJ	6	110-kv. post insulators
—	AK	—	Unit insulator assembly
—	AL	—	Unit insulator assembly
3	AM	3	Three-bolt parallel groove clamps
6	AN	6	Four-bolt parallel groove clamps
—	AN	—	Unit insulator assembly
3	AO	3	Stranded cable connectors
1	AP	1	Set of three-phase numbers
2	AR	2	Standard company locks
1	AS		Manual control mechanism
1	AT	1	Screen
	AU	1	Two-pole single-throw knife switch, 30 amp. 250 volt.
1	AV	2	Insulating platforms
	AW	2	Porcelain tubes 1½ x 8 in.
	AX	2	Telephone insulators
	AY	2	Wood brackets
1	AZ	1	Standard switch
	BA		
	BB		
3	BC	3	Air-break switch jumper connectors
100 ft.	BD	100 ft.	Extra flexible cable
100 ft.	BE	100 ft.	Hard-drawn cable
	BF	40 ft.	1½-in. Sheroduct conduit
1	BG	1	"High-voltage" sign
	BH	50 ft.	Three-conductor No. 6 lead-covered cable
	BJ		
	BK	2	Four-bolt parallel groove clamps
	BL	2	¼-in x ½-in. stove bolts with nuts
	BM	1 pc.	Sheet metal 1/16 x 2½ in. x 5 in.

were cleaned out with a digging shovel and spoon. This method of excavating deep pole holes proved very satisfactory and economical.

Poles were erected by means of the standard type gin pole, with rigging and double team, and all poles were framed after erection. Brace rods and bolts were loosely bolted to the crossarms and the insulator strings hooked in the suspension eyebolts before the crossarms were raised.

Conductors were pulled out with double teams and at each structure were suspended in heavy roller bushed polished galvanized steel sheave wood snatch blocks, these blocks being suspended by stranded steel wire slings of the same length as the insulator string. The conductors were allowed to drag on the ground while being pulled out, but were protected by piles of brush where there was danger of abrading the conductors. Conductors were sagged with blocks and double teams, the sag being determined by sag targets placed in the longest span of the section to be sagged. After the conductors were sagged and allowed to set the sag was checked in the shorter spans of the section.

TABLE V—DIVISION LINE CONSTRUCTION ORGANIZATION

Division Warehouse:
Distributing center for small line materials, equipment, etc.

Division Office:
Headquarters for division general foreman, division field engineer, division timekeeper, division material man, etc.

Right-of-Way Clearing:
Two floating crews (24 men each) of local labor. Crews boarded themselves and were transported to and from work in company trucks.

Anchor Setting:
One crew of sixteen men with one ¾-ton truck. Crew lived in boarding houses and installed concrete anchors only.

Pole and Wire Distribution:
One camp crew of thirty men with two five-ton trucks and four mule drays. Crew worked night and day shifts distributing poles, crossarms, wire and insulators.

Pole Setting and Framing:
One camp crew of six linemen and 30 laborers with two road wagons and one four-mule dray. Crew excavated pole and slug holes, erected poles and framed structures.

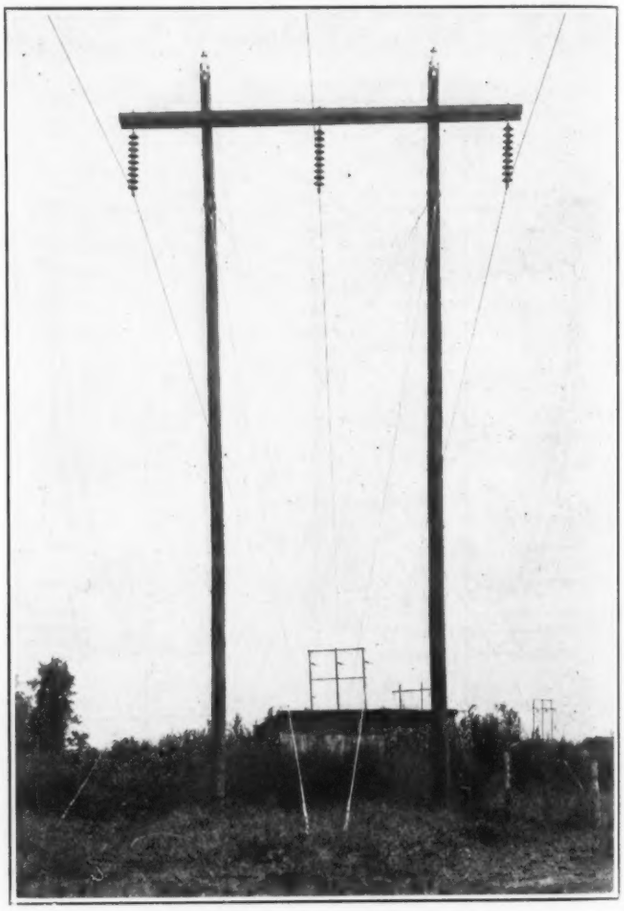
Wire Stringing:
One camp crew of twelve linemen and 35 laborers with four road wagons and one four-mule dray. Crew installed guys and strung wire.

After construction work was complete on sections of the line, an inspection was made by representatives of the transmission, operating and construction departments. Incomplete construction details that would impair the serviceability of the line were noted and corrections made later by the line crews.

General Information

The line was completed in eight months, after the construction force was fully organized, which represents a construction rate of more than one mile of line per working day. An average of approximately 400 men composed the two division line organizations during the greater part of the construction period. Unusually fine weather prevailed during the construction period from May to January, and construction was not delayed with the exception that the hauling crews were handicapped by rains and hot weather during the first two months of the period.

This line cost approximately 10 per cent per mile less than former types of "H" frame lines built, and although the line has been in service only five months, there is every reason to believe that it will prove entirely satisfactory, as the design was based on operating experience with 627 miles of somewhat similar type "H" frame 110-kv. lines of the Alabama Power Company system. The only modification in design deemed necessary at present is the necessity for side guying every structure in sections subject to high winds where the soil is of sandy loam extending to a depth of 4 ft. or 5 ft. Soil of this nature was encountered on several sections of the line and the side guying of all structures was proved necessary by two or three unguyed structures blowing over to a dangerous angle during wind-storms. In some instances the sandy loam extended to such depth that concrete guy anchors could not be installed due to the caving in of the holes.



DOUBLE-ARM SINGLE-SUSPENSION STRUCTURE, TYPE B

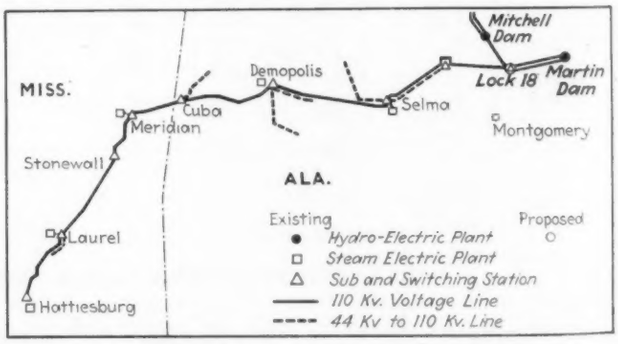


FIG. 12—LOCK 18-HATTIESBURG 110-KV. LINE OF THE ALABAMA AND MISSISSIPPI COMPANIES

The Dixie Construction Company has under construction for the Alabama Power Company at the present time 266 miles of wood-pole "H" frame 110-kv. lines with support structures similar in design to the type used on the Lock 18-Hattiesburg line. These lines are being constructed as a part of the Alabama Power Company and Gulf Electric Company system.

Proposed Allocation of Demand Costs*

New Plan Proposed for Fixed Cost Allocations—Adaptable to Systems with or Without Fixed Peaks—What the "Phantom Customer" Does to Equalize Costs Outlined

By H. W. HILLS
The Philadelphia Electric Company

IN THE development of a reasonable method of allocating fixed charges, there are several vitally important factors to be considered if reasonably correct results are to be obtained:

1. The size of the customer's maximum demand is in itself relatively unimportant except in those cases where it is large enough to determine the station peak. The thing that determines the generating capacity of a central station is not the individual maximum demands of the customers. It is possible for a central-station peak to occur at one time, while the individual maximum demands of its customers, or even groups of customers, may occur at totally different times. This is often the case in actual practice.

2. A 100 per cent load factor customer monopolizes the use of equipment sufficient to supply his maximum demand all the time, and hence diversity of use with another customer is impossible. Therefore the fixed costs allocated to him must agree with those obtained by the peak responsibility method.

3. Those customers with less than 100 per cent load factor may have diversity of use with other customers, and hence the fixed cost per kilowatt should be divided among all customers who participate in such diversity of use. This means that the fixed cost per kilowatt will be larger for a 100 per cent load factor customer than one with a poor load factor. However, the fixed cost per kilowatt-hour will be larger for the customer with a poor load factor than for the one with a good load factor.

4. The fixed expense on equipment that is idle a great part of the time should be borne by those responsible for this cost.

5. To all customers, both those on the peak and those off peak, should be allocated a capacity cost or rental charge sufficient to cover the fixed costs of that equipment during the period of time it is used. This may be made clearer by considering the fact that energy consumption is the product of two things, demand and time. It is as impossible to generate a kilowatt-hour without using plant capacity equivalent to 1 kw. for a period of time equivalent to one hour as it is to generate a kilowatt-hour with no equipment at all. The generation cost of each kilowatt-hour should, therefore, include the portion of fixed costs due to the plant capacity that was tied up for that time. This cost is merely a rental cost for the period of time plant capacity was actually used.

Let us take the ideal case of a central station with 100 per cent load factor. To accomplish this result every kilowatt of generating capacity, exclusive of reserve, must be operated all the time. Hence each kilowatt-hour that is generated is just as important as another regardless of the time it is generated, for the loss of a definite load for a period of time, as one hour, will affect the load factor and hence efficient operation of the plant exactly the same regardless of the time at which this loss occurs, whether it is day or night, summer or winter.

For the purpose of analysis, let us take a central-station load as indicated in Fig. 1. Here we have six groups of customers, A, B, C, D, E and F, with loads

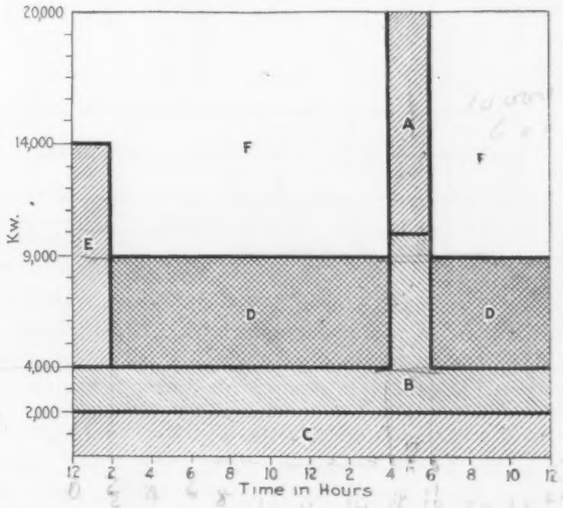


FIG. 1—ANALYSIS FOR PHANTOM CUSTOMER ALLOCATION

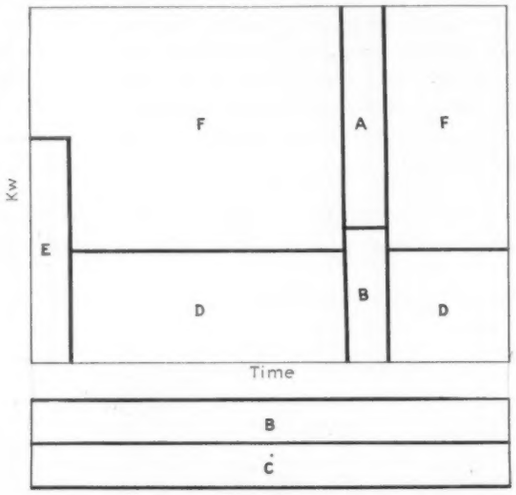
as indicated, so that the combined load of all of them results in 100 per cent load factor operation of the generating plant. By inspection we see that the load curves of the various groups can be divided into two parts: One part, the so-called base load, operates at 100 per cent load factor, and the other part is composed of the various peaks. Many groups of customers have practically no base load and hence fall entirely in the second class. Some groups, very rare, may have 100 per cent load factor and fall entirely in the first class. We shall therefore divide the central-station load into these two parts, according to Figs. 2a and 2b.

Let us first consider the case of Fig. 2a. How are we going to divide the total fixed charges among the customers? Can we use the peak responsibility method? Obviously not, for there is no peak. Can we divide the expense among them in proportion to their individual demands? Yes, but the results would not be fair. They would charge the short hour user too little and the long hour user too much. If two of these customers have the same kilowatt-hour consumption, the loss of either customer will affect the load factor, or efficiency of

*This concludes the paper which was granted the Henry L. Doherty prize by the N.E.L.A. prize award committee in 1926. The first installment appeared in ELECTRICAL WORLD for Jan. 22 and discussed methods of allocating fixed charges on a comparative basis.

plant use, the same, regardless of the fact that one might have twice the demand of the other. This leads us to the conclusion that in this case a fair and just division of cost will be on a kilowatt-hour basis, for every little block of energy used is just as important as every other block of the same size as far as cost to the central station is concerned.

With 100 per cent load factor customers the total fixed charges divided by the number of kilowatt-hours generated and multiplied by the consumption of each customer at the generating plant will give the true fixed cost that should be allocated to each customer. So, with a plant operating at 100 per cent load factor, the



FIGS. 2A (ABOVE) AND 2B (BELOW)—DIVISION OF CUSTOMERS INTO TWO GROUPS BASED ON LOAD FACTORS

fair and just method of dividing the fixed expenses is according to the customers' hours use of plant capacity, and this means according to their kilowatt-hour consumption (corrected, of course, for power factor).

THE PHANTOM CUSTOMER

In actual practice, needless to say, the load factor is usually between 40 and 60 per cent instead of up around 100. But our line of reasoning will still apply if we take into account an imaginary customer needed to give us the ideal condition. Such a customer is represented by F in Fig. 2. We can now divide our fixed charges among these six groups according to their kilowatt-hours consumption, charging this phantom customer in the same way as we do the rest. Of course we cannot render a bill to a phantom customer and collect any money, and of course the central station cannot pay this bill, for the only revenue it receives is from its customers. So now the problem is to divide the bill of this phantom Customer F, which would be required to operate the existing plant at 100 per cent load factor, among the existing customers in an equitable manner.

What customers are responsible for this condition existing whereby we need a phantom to give us 100 per cent operation of our plant? Certainly it is not those who already have a 100 per cent load factor. Neither is it those customers who are off peak, for they are doing their share toward reducing the size of this phantom. It is therefore evident that the responsibility for the existence of anything less than 100 per cent load factor rests entirely on those customers who are responsible for the peak load. And these customers that cause the peak are responsible because they use more than their average demand during the period of that peak load.

So in the above case we have a peak of 20,000 kw. Obviously Customer D has nothing to do with this high demand, for he does not use any current during that time. Neither is this peak due to Customer C, for he is using only his average demand. This high demand is due solely to Customers A and B, and so they should have divided between them the bill that would be rendered to the phantom Customer F.

A NUMERICAL EXAMPLE

Let us take definite figures. If the total fixed charges for a 20,000-kw. plant are $100,000 per month, the average fixed charge under 100 per cent load factor operation equals 0.694 cent per kilowatt-hour.

$$\$100{,}000 \div (20{,}000 \times 30 \times 24) = 0.694 \text{ cent}$$

Kilowatt-hours—

Customer A: $10{,}000 \times 2 \times 30 = 600{,}000$ per month

Customer B: $2{,}000 \times 24 \times 30 + 6{,}000 \times 2 \times 30 = 1{,}800{,}000$ per month

Customer C: $2{,}000 \times 24 \times 30 = 1{,}440{,}000$ per month

Customer D: $5{,}000 \times 20 \times 30 = 3{,}000{,}000$ per month

Customer E: $10{,}000 \times 2 \times 30 = 600{,}000$ per month

Total kilowatt-hours, all customers: 7,440,000 per month

Total kilowatt-hours at 100 per cent load factor: 14,400,000 per month

Kilowatt-hours, phantom F: 6,960,000 per month

Demand charge to phantom F:

$$6{,}960{,}000 \times \$0.00694 = \$48{,}250 \text{ per month}$$

This amount is to be divided between customers A and B in proportion to their contribution to the peak.

Now the only reason there is a peak load is because these customers use more than their average demand at that particular instant. If they used their average demand or less at that particular time, it is perfectly evident they would not contribute toward a peak at that time. They might tend to create a peak load at some other time, but that does not matter under the existing conditions, for by so doing they would actually be helping to reduce the consumption of the phantom customer and therefore their peak would be advantageous to the central station in getting rid of the valleys in the daily or annual load curve. The only customers who are responsible for the peak are those who use more than their average demand at that time, and their degree of responsibility is limited to the excess demand over the average.

The average demand equals total consumption divided by total hours:

For Customer A:

Average demand: $600{,}000 \div (24 \times 30) = 833$ kw.

Demand on peak: $= 10{,}000$ kw.

Excess demand on peak: $= 10{,}000 - 833 = 9{,}167$ kw.

For Customer B:

Average demand: $1{,}800{,}000 \div (24 \times 30) = 2{,}500$ kw.

Demand on peak: $= 8{,}000$ kw.

Excess demand on peak: $= 8{,}000 - 2{,}500 = 5{,}500$ kw.

Total kilowatt load contributing to peak $= 9{,}167 + 5{,}500 = 14{,}667$ kw.

The demand charge of phantom F is therefore divided between the customers causing the peak according to their responsibility as follows:

Demand charge of phantom F = $48,250.

$48,250 ÷ 14,667 = $3.29 per kw. of demand in excess of average

For Customer A:
Demand charge because of peak load: \$3.29 × 9,167 = \$30,240
Demand charge because of actual hours use of plant capacity: 600,000 × \$0.00694 = \$4,170
Total demand charge: \$30,200 + \$4,170 = \$34,410 per month
For Customer B:
Demand charge because of peak load: \$3.29 × 5,500 = \$18,100
Demand charge because of energy consumption: \$1,800,000 × \$0.00694 = \$12,500
Total demand charge: \$18,100 + \$12,500 = \$30,600 per month
For Customer C:
Demand charge because of energy consumption equals total demand charge: 1,440,000 × \$0.00694 = \$10,000 per month
For Customer D:
Demand charge because of energy consumption equals total demand charges: 3,000,000 × \$0.00694 = \$20,820 per month
For Customer E:
Demand charge because of energy consumption equals total demand charge: 600,000 × \$0.00694 = \$4,170 per month

	Kw.-Hr.	Kw. Demand On Peak	Kw. Max. Demand	Demand Charge
A	600,000	10,000	10,000	\$34,410
B	1,800,000	8,000	8,000	30,600
C	1,440,000	2,000	2,000	10,000
D	3,000,000	0	5,000	20,820
E	600,000	0	10,000	4,170

Comparison of Various Methods

The faults in other methods of allocating demand charges are shown by comparing these results with those obtained by using other recognized methods. The following table shows the results obtained by the different methods given in dollars per month.

	Peak Responsibility	Kw.-Hr.	Kw. Max. Demand	Eisenmenger Theory	Greene's Theory	Phantom Customer
A	\$50,000	\$8,070	\$28,580	\$23,125	\$22,140	\$34,410
B	40,000	24,200	22,840	29,155	23,290	30,600
C	10,000	19,360	5,720	15,280	10,000	10,000
D	0	40,300	14,280	20,835	22,430	20,820
E	0	8,070	28,580	11,605	22,140	4,170

Applying the average fixed cost of \$5 per kilowatt per month to the above table, we get the kilowatts allocated to each group of customers, which is as follows:

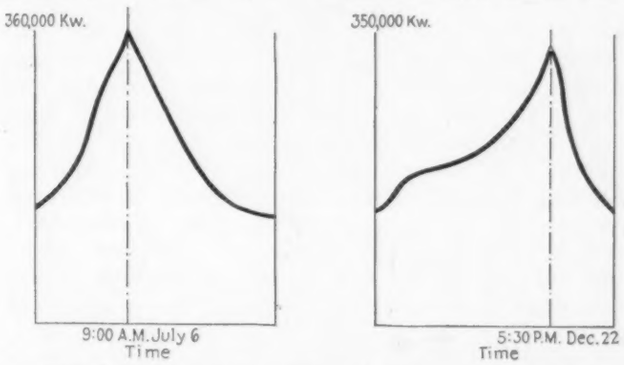
	Peak Responsibility	Kw.-Hr.	Kw. Max. Demand	Eisenmenger Theory	Greene's Theory	Phantom Customer
A	10,000	1,614	5,716	4,625	4,428	6,882
B	8,000	4,840	4,568	5,831	4,658	6,120
C	2,000	3,872	1,144	3,056	2,000	2,000
D	0	8,060	2,856	4,167	4,486	4,164
E	0	1,614	5,716	2,321	4,428	834

The peak responsibility method is obviously in error in every case except where the customer has 100 per cent load factor. The off-peak customer D is charged nothing for the use of the company's equipment and so is of no benefit to the company. It is unfair to Customers A and B, who are on at the time of the station peak, to make them pay all the fixed charges and let the off-peak customers pay nothing, for is not the plant capacity as necessary to serve an off-peak as well as an on-peak customer? The off-peak customer should certainly pay his share of expense for the use of equipment, for the current charge, or variable cost, is not sufficient. The only customer charged correctly is C, who has 100 per cent load factor.

Apportioning the stand-by charges according to straight kilowatt-hour consumption is also plainly wrong, for here Customers A and B, who are on when the station peak occurs, do not use enough kilowatt-hours to pay for the cost of serving them, whereas the off-peak and 100 per cent load Customers C and D pay too much. Also off-peak customers bear the same burden as on-peak customers, which is unfair.

The error in using only the individual kilowatt maximum demands is also made evident in the above table, for here we have the 100 per cent load factor customer paying only 57.2 per cent of his fixed costs. This shows the importance of considering the hours use of plant capacity. Other considerations also show this method to be unjust, for it charges an off-peak customer the same per kilowatt as one on the peak.

The fault in the Eisenmenger theory shows up in charging Customer C, a 100 per cent load factor customer, for more than he ever uses. When a customer's demand is never in excess of 2,000 kw., a charge of 2,321 is plainly too high. And Customer A, who is responsible for the peak load, is not charged enough. Otherwise this method gives fairly reasonable results, especially for the off-peak customers.



FIGS. 3 AND 4—PHANTOM CUSTOMER METHOD CAN BE APPLIED IF PEAKS OCCUR AT DIFFERENT TIMES

Mr. Greene's method compares very favorably with the other methods and gives results that are fair and reasonable with one exception. It charges the two customers A and E the same, although A is on the peak and is responsible for a large central-station investment, whereas E is entirely off-peak and requires no additional investment to serve him.

The phantom customer method apparently allocates the costs on an equitable basis. The peak customers who are responsible for the large investment have allocated to them the costs they incur. To the off-peak customers is allocated a cost to cover merely a fair rental for the hours use of plant capacity and this relieves the burden on the peak customers in proportion to the amount of current consumed by these off-peak customers. The 100 per cent load factor customer does not benefit by central-station service as much as do those customers with a poor load factor, for he has no diversity with other customers and has to carry the entire fixed costs of the equipment used to serve him, whereas other customers can share this cost between them. However, his fixed cost per unit of output is just as small as that of the off-peak customer. It may seem wrong to charge Customer E, who has a demand of 10,000 kw., for only 834, although he is entirely off-peak. But under the conditions this is fair and reasonable, for this demand is being used at such a time that no added cost is caused and it is merely an allocation of existing costs so that he will be charged a fair amount for use of the equip-

ment. If this demand should increase so that it might shift the peak on the station, then it will be necessary to include this customer in the allocation of the phantom customer's bill, and this can be accomplished quite easily by merely considering this customer as being on at the time of the station peak.

OPERATING WITH TWO OR MORE ANNUAL PEAKS

In many cases it may be that there is not only one station peak during the year due to one set of conditions, but perhaps two or more at other times due to different groups of customers or under different conditions. It often happens that the annual station peak is just as likely to occur due to one group of customers as another. Let us assume a concrete case.

Suppose that investigation of the daily load curves shows two outstanding peaks as indicated in Figs. 3 and 4. In Fig. 3 the peak was caused by the combination of a high pumping load for irrigation purposes superimposed upon a high industrial load. In Fig. 4 the peak was caused by coincidence of high railway load with high lighting load. The most cursory inspection of such a condition will show the futility of applying the peak responsibility method to this case, for either group of customers may cause the actual peak, and any one associated with a power company knows that the rates for service cannot be changed at will year after year. Moreover, it is not fair to make one group of customers carry all the burden of fixed charges and allow the others free use of that same capacity. This is a case where the phantom method can be applied with accuracy and ease.

The demand charge is figured out on the kilowatt-hour basis as before by taking into account the phantom necessary to operate the plant at 100 per cent load factor and figuring out his bill accordingly. The contribution of each group of customers to the various peaks is next computed by subtracting their average demand from their demand at the time of the station peak. (The average demand is obtained by dividing the kilowatt-hours consumed plus the distribution losses by the number of hours in the year.) These contributions thus obtained of the various groups of customers to the station peaks are added together and the phantom's bill is divided among these groups accordingly. The total demand or fixed charge then equals the sum of the portion of the phantom's bill plus the amount obtained on the above kilowatt-hour basis of comparison.

The results of this phantom method enable us to know definitely what an off-peak customer should pay if he is to pay a fair and just charge for use of the company's generating, transmission, substation capacity, etc. If he pays more than this cost, in addition to the other costs of service, then we know that he is a profitable customer. If he pays less, he is not paying his just share of expenses, but he may still be profitable to some extent if he pays more than the variable charges. This method is not intended to replace the increment cost basis or other acceptable commercial methods or policies for developing and extending the use of central-station energy. Rather it is offered to supplement these existing methods by giving fairly accurate data on which to start. Of course, this method applies only to that equipment used in common by the various classes of business concerned. For the fixed costs of distribution line equipment where separate services are run to each group of customers, the maximum demand method is undoubtedly the fairest.

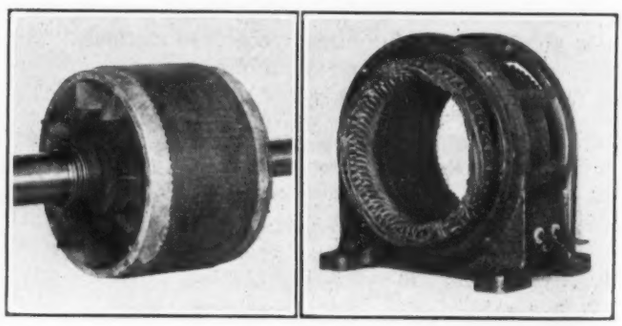
Because the off-peak customers were allocated costs proportional to their kilowatt-hour consumption does not mean they should be charged that way. The various methods of charging are designed to cover considerations of all kinds and of course these methods cannot agree with methods of cost analyses. But the results of the cost analysis can be applied to the various rate forms so as to obtain fairness with accuracy.

70 Hp. from 20-Hp. Motor Frame with Asbestos Insulation

BY JOHN T. STONE
Industrial Engineering Department, General Electric Company

UNTIL a few years ago the operation of electrical machinery at very high temperatures was considered almost impossible, because there were few suitable insulating materials available. However, the discovery of several sources of iron-free asbestos led to investigation into the possibilities of high-temperature apparatus, with some interesting results.

One of the practical high-temperature machines developed by General Electric was a 1,200-r.p.m. induction motor. The stator winding is of the bar type with silver-soldered joints and insulated with asbestos. The rotor is of the indestructible cast-aluminum type. As



ROTOR AND STATOR OF SPECIAL HIGH-TEMPERATURE INDUCTION MOTOR

first built, this motor was equipped with bakelized wedges, but the high temperature attained under full load soon indicated the need of some other wedge material. After experimenting, wedges of slate were found to be the most satisfactory.

The machine was built in the frame ordinarily used for a 20-hp. motor, with the exception of the bearings and shaft, these parts being made large enough mechanically to transmit a load of 50 hp. By reason of the asbestos insulation it was possible to give the motor a rating of 50 hp. This motor actually carried 70 hp. successfully. Temperatures as high as 260 deg. C. with a 50-hp. load and 350 deg. C. with a 70-hp. load were reached, with no apparent damage to the insulation.

Later this motor was put in actual service and has been operating for more than two years at very nearly its rated load of 50 hp.

Although this motor was more or less experimental, the results indicate the feasibility of such motors for certain applications, such as those involving very heavy overloads or operations under conditions of very high ambient temperatures.

Letters from Our Readers

Designing Direct and Indirect Illumination

To the Editor of the ELECTRICAL WORLD:

In view of the article by Alfred A. Wohlauer on "Illuminometric Calculations Using Rectangular Coordinates," which appeared in the Dec. 18 issue of the ELECTRICAL WORLD, it might be of interest to your readers to refer to the comments printed in the Oct. 9, 1920, issue and made by M. M. Samuels and the writer, entitled "Designing Direct and Indirect Illumination."

The last-named article describes in detail a practical method which has been checked in actual installations and has shown sufficient accuracy for all ordinary purposes. The article also gives a simple method showing how new curves of illumination may be derived from measured curves for other planes or levels without the necessity of referring to or deriving the polar curve. The method has an advantage in that it eliminates and makes unnecessary the need of the cosine-cubed values which always seem to be a deterrent to many who desire to make use of this general method.

The desirability of using the point-by-point method, as pointed out by your correspondent, is to be commended, since the methods in general vogue which give average values may be very misleading, particularly when great uniformity of illumination is desired. The apparent drawbacks of this method have been much exaggerated on the score of tediousness of handling, while it is actually a fact that for any particular layout there are so many recurring points having the same value that the actual number to be considered are comparatively few. As an actual example, a certain installation requiring an average illumination of 12 foot-candles showed, when laid out by conventional methods, that there existed a maximum of 20 foot-candles with a minimum of 7 foot-candles. These values were obtained through a simple point-by-point analysis which brought to view the inherent shortcomings of the conventional method. It was also possible to obtain curves of illumination through particular sections of the space.

The attention of your readers is also directed to a "Nomographic Chart for Designing Illumination," by Emil Kun, on page 801 of the ELECTRICAL WORLD, April 7, 1923.

C. OTTO VON DANNENBERG.
General Engineering & Management Corporation.
New York City.

Rockland Electric Company Absolved

To the Editor of the ELECTRICAL WORLD:

In the issue of your publication for Dec. 25, 1926, a letter from the writer appeared regarding experience with extending power lines in rural communities. This letter was dated from Allendale, N. J., a territory served by the Rockland Electric Company, but the experience referred to took place elsewhere. I feel that my first letter casts a reflection on the Rockland company which is undeserved, particularly in view of the fact that it sent a man to install a meter at my present residence upon an hour's notice, even though this notice was given at 7 p.m. The company with which I dealt previously required six days after the line was completed to install the meter, even though its line was not finished until several months after the time promised.

EDGAR H. FELIX.
Allendale, N. J.

Improvised Control Method Defended

To the Editor of the ELECTRICAL WORLD:

My attention has been called to the letter in your Dec. 11 issue under the caption "Improvised Control Methods Criticised," signed by W. S. Pfeifer of the Allen-Bradley Company, Milwaukee. As the engineer responsible for the entire design and installation, may I submit the following:

The article in your issue for Oct. 9 to which Mr. Pfeifer takes exception suffered from editorial "blue-penciling," and I regret that the following sentence was omitted: "The practice of using reduced copper sections in supply lines, being in conflict with established National Electrical Code requirements, may lead to objections by inspection services and should therefore be undertaken carefully." My personal thought is that service lines can in many cases be reduced below the code requirements, which are of course proportioned for starting currents, and that the additional drop thus introduced will permit simplified starting apparatus with motors of the FTR or similar (high-starting-torque) type, always keeping in mind, however, permissible limits for voltage drop under maximum running loads.

As to Mr. Pfeifer's remarks regarding contactor closing on reduced voltage, he has evidently overlooked the fact that the low-voltage condition spoken of does not occur until after the contactor has closed, practically full-line voltage being available for contactor operation in every case. The period of acceleration and low voltage at the motor terminals is on the order of two and one-half to three seconds, after which only normal line drop of about 2 per cent is in evidence. The amount of "undue heating during the starting cycle" has not been detectible.

The contactors used comply with the Electric Power Club requirement of satisfactory closure on 85 per cent of normal voltage and will not drop out after closing unless the voltage drops to 40 to 50 per cent of normal. The only question in this installation of any importance whatever was whether the momentary voltage drop incident to the starting of the second pump might not affect the starter of the first pump, which was already in operation. With this thought in mind, the copper reduction was made largely in the line between the controls and the individual motors, the feeder of course being proportioned for the maximum running loads of both motors. Under these conditions the control contactors have full voltage available for closing, and only one is subjected to a momentary drop, which does not affect its "holding" ability.

The increasing tendency toward the elimination of "auto-starters" and similar apparatus in conjunction with induction motors is very much in evidence. The development of "high-starting-torque" and "low-starting-current" motors has convinced many engineers that starters are a needless source of complication and expense in numerous cases, and the attitude of many of the power companies is in accord with the contention that throwing a motor of 10 hp. to 25 hp. directly across the line has really a far less disturbing effect than would have the starting through an "auto-starter" of a 50-hp. to 100-hp. motor, to which latter operation no objection is offered. The installation in question has now been in operation nearly nine months with complete satisfaction to all concerned.

H. B. BARNES.
Consulting Engineer
Denver, Col.

Central Station and Industrial Practice

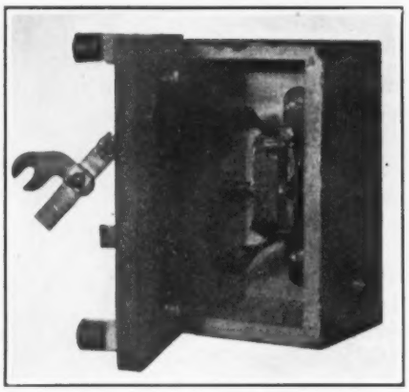
Phase-Rotation Indicator

BY CARL J. FUHRMANN
Superintendent Electric Meters Consumers Power Company, Jackson, Mich.

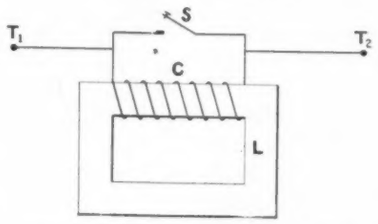
A SIMPLE device for the determination of the direction of phase rotation is used in conjunction with ordinary meter-testing equipment by the Consumers Power Company at Jackson, Mich. The device is nothing more than an ordinary 5-amp. current coil with its laminated-core pole pieces bridged by an iron plate to complete the magnetic circuit. The terminals of the coil may be short circuited by the switch *S* shown in the illustration.

In operation the device is connected in series with the current coil of a rotating standard in the secondary of a phantom load. The primary of the phantom load is connected across one phase of a three-phase circuit and the potential coil of the standard across another. A 5-amp. load is impressed in the current circuit.

Due to the three-phase relation between the current and potential on the standard there is an angular difference, which is leading or lagging according to the direction of phase rotation. With one switch *S* closed the revolutions of the standard are noted for a one-minute interval as timed by the second hand of an ordinary watch. The switch is then opened, thus introducing an inductive reactance into the current circuit and causing the current to lag from its former angular position. The revolutions are then noted.



ARRANGEMENT OF PARTS OF PHASE-ROTATION INDICATOR



CONNECTIONS OF PHASE-ROTATION INDICATOR

If the second number of revolutions is greater than the first, it is evident that the current has been brought more nearly into phase with the potential on the standard and consequently the current must have been leading in the first check. The phase from which current is being taken is thus shown to lead the phase to which the potential coil of the standard is connected.

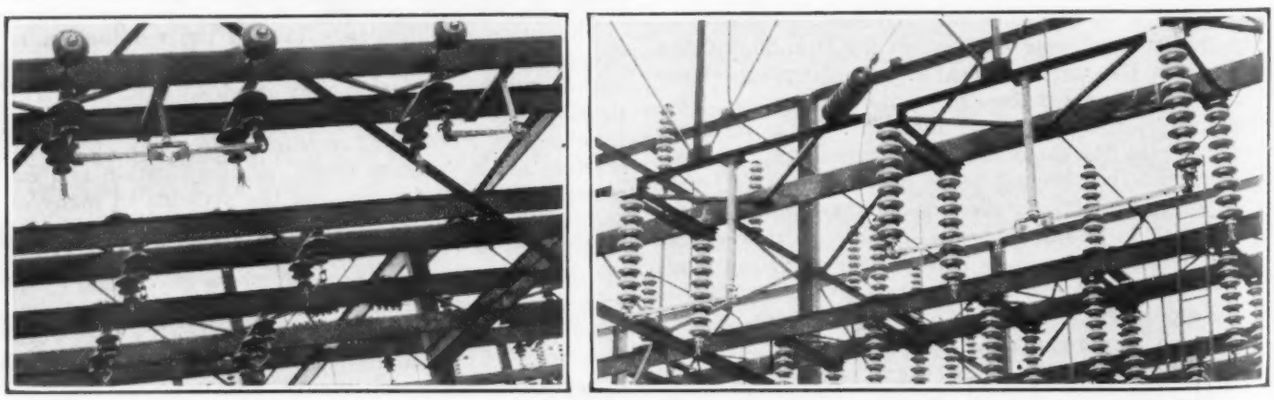
If the second number of revolutions is less than the first, it follows that the current in the first check was lagging and the reactance of the device has caused it to lag further, with the consequent result of lower speed of the standard. In this condition the current phase is lagging the potential phase. It is advisable that this test be checked by taking current for the phantom load from the third phase to obviate any chance of error in the indication of rotation.

Utica Uses Combination Disconnect-Ground Switch

BY N. E. EMMONS
Superintendent Maintenance Department Utica Gas & Electric Company, Utica, N. Y.

A NEW TYPE of switch that serves as a disconnecting and grounding device is being used by the Utica Gas & Electric Company in its Deerfield station, which is now under construction but in partial operation already, a 66/44-kv. section having been put in service on Dec. 12. It is the intention to step 110 kv. down to 44 kv. at this point immediately after the first of the year.

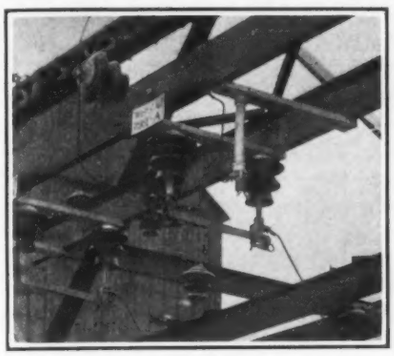
Two styles of these disconnects are shown herewith, the larger size being for 110-kv. operation and smaller types for 44-kv. service. A feature of this switch is the grounding arrangement provided for the knife blade when in the open-circuit position. A ball-bearing swivel joint, hinging the knife blade to its suspension unit, permits the rotation of the unit to 90 deg. and engagement with grounding clips. As will be observed from the illustration, the disconnects for two phases



AT LEFT, DISCONNECT SWITCHES INSTALLED ON 44-KV. CIRCUIT AND SHOWN IN GROUNDED POSITION WITH LINES DEAD. AT RIGHT, 110-KV. INSTALLATION OF DISCONNECT SWITCHES SHOWING THE LINES DEAD AND BLADES GROUNDED

use a common ground connection, located conveniently between their suspension insulators. In the immediate background can be seen the other insulator string assembly, carrying the fork contact terminals.

The deciding factor in purchasing



44-KV. INSTALLATION SHOWING DISCONNECT SWITCHES CLOSED AND THE LINES WORKING

this type of disconnect switch was the greater factor of safety for the men working on the line. Whereas in the past there was always a chance of a workman neglecting to ground a line before commencing work, it will now be grounded by the disconnect switch at the station with one operation when the switch is pulled out to clear the line. It will still be the practice, however, to ground lines on each side of the section being worked upon.

This station where these disconnect switches are being tried out for the first time is one of the several switching stations on a 110-kv. line owned by the Adirondack Power & Light Corporation. It runs approximately east and west across the State of New York, with branches at the switching points to territories north and south. At this particular station there enters from the west and the north three 110-kv. lines. Leaving the station in an easterly direction is one 110-kv. line to Inghams Mills that eventually will be duplicated. Two 44-kv. lines connect this switching station with the main distribution point of the company at its Washington station.

Automatic Dispatchers' Board at Headquarters

A LOAD dispatchers' board controlling the entire northern portion of the Public Service Electric & Gas Company's transmission system has just been completed and located in the company's main office building, at Newark, N. J., convenient to the records and operating department's facilities.

The usual red and green indicating lamps are employed to show the positions of the various oil-circuit breakers in the transmission system. For the Essex division, the Essex, Marion and Kearny generating stations and the Elizabeth and Bayway substations of the central division these indications are automatic, and the apparatus used to accomplish this is the distributor type of supervisory-control and remote-indication equipment furnished by the General Electric Company. There are 22 distributors in all, located one in each of fifteen substations, two each in Marion and Kearny generating stations and three in Essex generating station. Four of the smaller substations do not have distributors, the positions of the oil-circuit breakers being indicated over direct-wire connections.

The positions of the oil-circuit breakers in the substations not equipped with automatic-indicating apparatus are shown by means of small control switches that light red and green lamps, the information for keeping these indications correct being obtained by telephone from the substation operators.

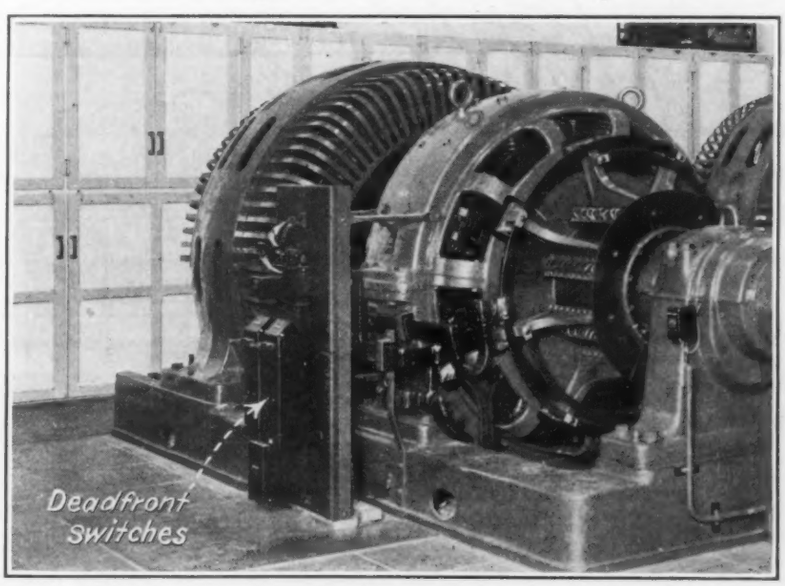
Provision has been made for four load-dispatching positions, with an extra position for the chief load dispatcher. Each operating position has a capacity of 40 telephone lines for dispatching purposes and, in addition, a special monitor-type switchboard has been provided for the chief load dispatcher with multiple connections to each of the 160 lines furnished by the four operating load-dispatching positions. All of these lines are not in use at the present time, ample provision having been made for future growth.

Unit Installing Costs for Automatic Regulator

A NEW ENGLAND central station recently installed a 34.5-kva., 150-amp., Westinghouse induction type regulator on a lighting feeder in its generating station at the following itemized expense:

Items	Number	Price per Unit	Sub-totals
34.5-kva. regulator	1	$1,245.00	$1,245.00
Potential transformer, 200 amp., 4,500 volts	1	18.70	18.70
Potential transformer, 20/1	1	3.00	3.00
No. 4-0, 5,000-volt cable, ft.	65	0.37+	24.36
No. 6, 5,000-volt cable, ft.	30	0.15—	4.46
Triple-pole, single-throw switch	1	3.66	3.66
No. 12, rubber-covered wire, ft.	196	0.04—	7.23
Transite board, ft.	110	0.20+	22.44
Labor	...	.....	266.68
Insurance charge	...	.....	5.65
Storeroom charge	...	.....	27.65
Miscellaneous small items	...	.....	12.94
Total cost			$1,641.77

Dead-Front Negative Switch on Railway Machine



INSTEAD of mounting the negative or equalizer switch exposed on the side of railway motor-generators, as is usually done, the Pacific Gas & Electric Company makes it a practice to inclose these switches in the manner shown in the accompanying illustration. This is in line with the general policy of covering all live parts of manually operated switches in substations for the protection of operators and others who may have occasion to be on the premises of the power company.

Eliminating Guesswork in Guying

BY I. H. GRONSETH
Electrical Distribution Engineer Board of Water and Electric Light Commissioners, Lansing, Mich.

GUYING of pole lines, important as it is, has apparently received very little attention from distribution engineers and others responsible for pole-line construction, due possibly to the difficulty of correctly interpreting existing tables and information relating to this subject. It appears as though some guys have been prescribed by guess instead of from stress calculations, with the consequence that the lines are usually underguyed, rather than overguyed.

The accompanying chart and tables, developed by the writer from information contained in the National Electrical Safety Code Handbook No. 3, eliminates this guesswork and is simple enough so that it can be understood and used by any one. The chart is for triple-braid, weatherproof copper wire, with stresses based on proper sag, loaded with ½ lb. of ice and under a wind pressure of 8 lb. The stresses as read from the chart are calculated for a span length of 100 ft. but will apply to any span length up to 300 ft. by using the proper multiplying constant shown in Table II. The size of guy can be read from Table I, which shows permissible stresses for galvanized standard steel strand at various leads of the guy.

The writer acknowledges his indebtedness to E. T. Anderson, electrical engineer Board of Water and Electric Light Commissioners, Lansing, Mich., and to Professors Corey and Naeter, Michigan State College, for their advice and criticism in the preparation of this chart.

TABLE I—MAXIMUM STRESS ALLOWED IN GUYS.

Lead of guy is the ratio of the distance between pole and anchor to the height of attachments above ground.

Size of Guy Wire, In.	L = Lead of Guy	S = Maximum Stress in Pounds to be Placed on Guy															
M.	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S
7/16	¼	880	½	1,600	¾	2,200	1	2,700	1¼	2,900	1½	3,150	1¾	3,300	2	3,400	3	3,550
½	¼	1,150	½	2,200	¾	3,000	1	3,500	1¼	3,900	1½	4,200	1¾	4,350	2	4,500	3	4,700
7/16	¼	1,500	½	2,900	¾	3,900	1	4,100	1¼	5,000	1½	5,400	1¾	5,650	2	5,800	3	6,001
½	¼	1,950	½	3,800	¾	5,100	1	6,000	1¼	6,600	1½	7,000	1¾	7,400	2	7,600	3	8,000

TABLE II—MULTIPLYING FACTOR (*K*) TO APPLY TO SPANS OVER 100 FT.

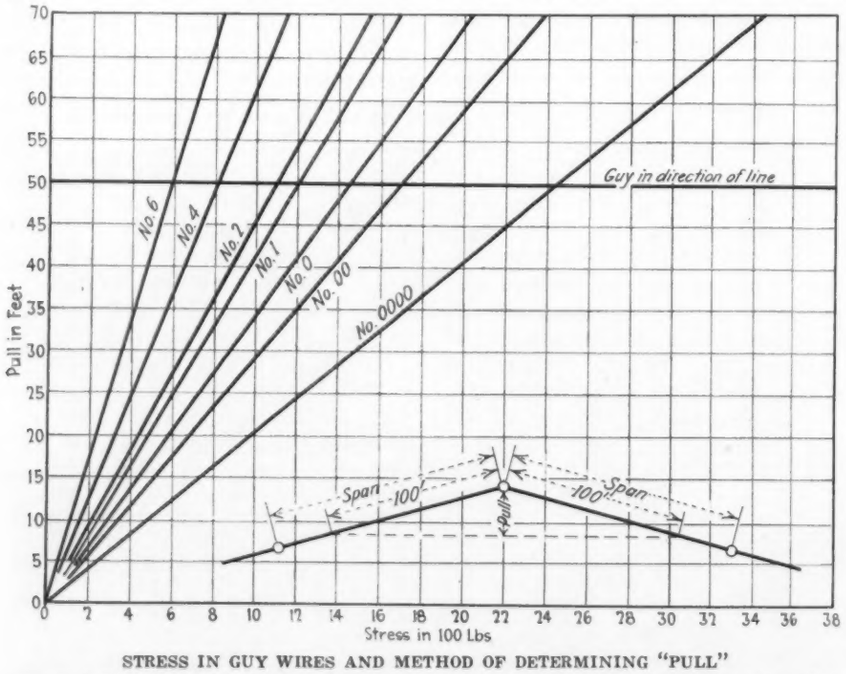
Span, Length Ft.	Size of Wire and Multiplier Constant K						
	No. 6	No. 4	No. 2	No. 1	No. 0	No. 00	No. 0000
125	K = 1.133	K = 1.1	K = 1.045	K = 1.083	K = 1.07	K = 1.06	K = 1.02
150	K = 1.2	K = 1.16	K = 1.18	K = 1.125	K = 1.103	K = 1.088	K = 1.082
175	.....	K = 1.22	K = 1.227	K = 1.29	K = 1.28	K = 1.235	K = 1.225
200	.....	K = 1.28	K = 1.363	K = 1.416	K = 1.379	K = 1.4	K = 1.346
250	.....	.....	K = 1.4	K = 1.416	K = 1.414	K = 1.47	K = 1.6
300	.....	.....	K = 1.36	K = 1.54	K = 1.517	K = 1.53	K = 1.7

Illustrative Problem.—Load consists of three No. 0000, three No. 00, four No. 2 and four No. 6 wires. "Pull" = 20 ft. Span length = 125 ft. What size guy shall be used?

Solution.—Using chart for the given pull, we find:

Size of Wire	Stress	No. of Wires × Stress × K		Stress, Lb.
0000	980	3 × 980 × 1.02	=	2,999
00	680	3 × 680 × 1.06	=	2,163
2	450	4 × 450 × 1.045	=	1,881
6	240	4 × 240 × 1.133	=	1,088
		Total	=	8,131

From Table I it may be observed that 8,131 = lb. stress corresponds closely to one ½-in. guy with a lead of 3, and this could be used. Or a combination of guys may be used as two ½-in. with a lead of 1½, two 7/16-in. with a lead of 1, three ½-in. with a lead of ¾, etc.



STRESS IN GUY WIRES AND METHOD OF DETERMINING "PULL"

To find the stress that will be exerted in a guy wire when it is placed in the direction of the line, follow the oblique line corresponding to the size of line conductor used to the intersection with the horizontal line marked "guy in direction of line" and read stress at bottom of chart.

To find the stress exerted in a guy when it bisects the angle in a line, follow the oblique line corresponding to the size of conductor used to the intersection with the horizontal line corresponding to "pull" in feet and read stress below. Multiply the values found by the number of conductors to get the total guy stress.

This chart is computed from data furnished by the National Electrical Safety Code Handbook Series No. 3 and is based on triple-braid weatherproof copper wire, 0 deg. F., ½-lb. ice load, 8-lb. wind pressure and 100-ft. span.

To calculate pull measure off 100 ft. on each side of corner pole and set up sighting bar, as shown in inset. The "pull" is distance in feet along a perpendicular line from corner to line between sighting bars.

Applying Tap-Changing Auto-Transformers

THE application and necessity of tap-changing auto-transformers at tie points to control wattless current and of phase shifters properly to divide load between two parallel lines were the subjects of a recent sub-committee report to the electrical apparatus committee of the Southeastern Division, N.E.L.A., by R. H. Bennett, Jr., Tennessee Electric Power Company.

The investigation as reported showed that none of the light and power companies in this division is at present using tap-changing underload transformers or phase-shifting transformers. Some of the companies are considering the use of such transformers, but no definite steps as yet have been taken to provide them, consequently the report is largely confined to a consideration of the tap-changing equipment being offered by manufacturers and the desirability or necessity of such equipment.

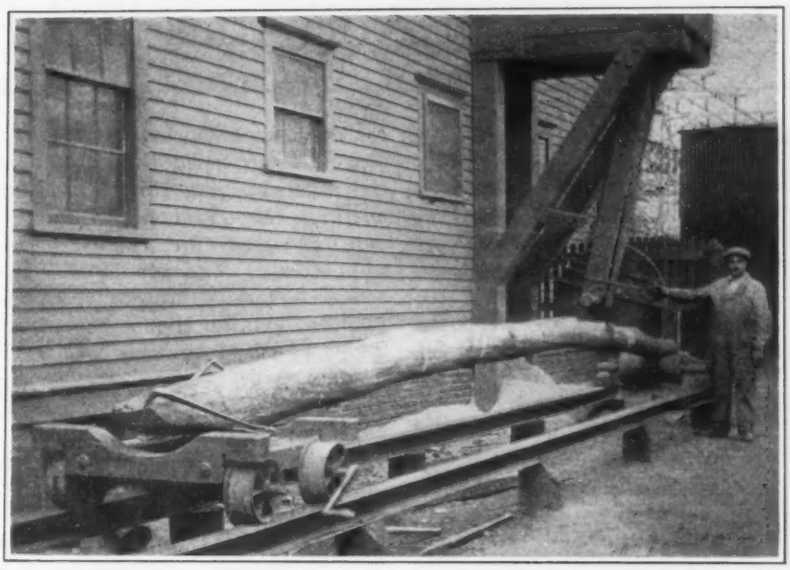
"Tap-changing auto-transformers" is taken to mean tap-changing underload transformers for connecting two electrical systems for the purposes of interchanging energy. Under this interpretation tap changing under load could not be applied to auto-

transformers except at a prohibitive cost, since all tap-changing equipment would have to be insulated for full-line voltage. If the interchange transformers are separate winding units with Y-connected windings, tap changing under load may be installed at a reasonable cost in that part of the winding near the neutral. Early developments of tap changing under load consist of bringing out a section of the winding near the neutral into a separate three-phase tank. Each phase in this tank consists of duplicate windings with a reactor and low-voltage oil-circuit breaker in series with each half of the winding. The operation would consist in opening the breaker in half of the winding, changing taps on it and then throwing all the load on the first half of the winding while taps were changed on the second half. Such a method of tap changing is not suitable for delta-connected transformers, except at a low voltage, according to the report.

One of the large manufacturers has brought out a tap-changing device that is applicable to either Y or delta transformers of any voltage without the use of high-voltage equipment in the tap-changing operation. This method consists of a third winding on the transformer, which will either buck or boost the line voltage. Taps are brought out on this winding and through a system of cams and oil-immersed contactors in a separate compartment on the side of the transformer tank. The amount of buck or boost of this winding can be varied. The cams may be manually operated or may be controlled by a voltage regulator or a contact-making kilovolt-ampere meter to maintain a certain voltage or kilovolt-ampere interchange. Such a system of tap changing under load can possibly be applied to transformers now in service at a reasonable cost, the report declares. Operating experience on this type of tap changing is not available but would be very useful.

Nearly every large company would like to have some method of control over the division of load in parallel lines or in lines which, although not parallel, tie two systems together. By the use of condensers the amount of wattless current may be controlled over tie lines, but the report declares that equipment has not yet been put on the market to control the kilowatt load over such lines, the only method of control at present being the governors on the two systems. Special transformers providing a phase displacement are being developed by which the energy load over these lines may be controlled. Such a development should be of great interest to all interconnected companies.

Utility Cuts and Sells Old Poles for Firewood



DISCARDED poles are turned into cash by the Worcester (Mass.) Electric Light Company by cutting them into 1-ft. lengths and selling them to employees at a nominal price. At the Faraday Street service station a 44-in. saw driven by a 20-hp. motor quickly disposes of everything except the butts, which are sold separately at a lower price and cut up by the purchaser. All poles are now accounted for from purchase to final delivery in the form of scrap wood; obstruction of yards is ended, and both company and employees gain by the disposal system adopted.

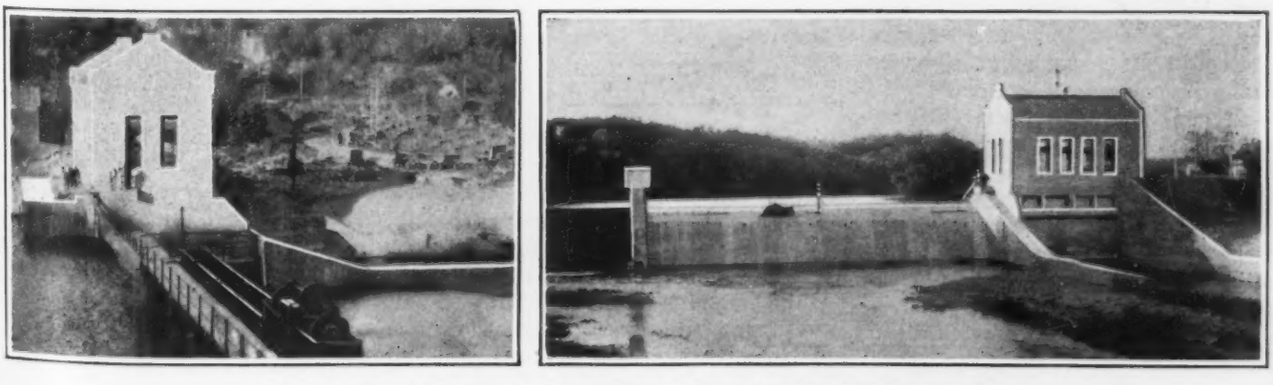
Automatic Hydro Plant on Cedar River

BY C. V. HULL

THE West Mitchell hydraulic plant of the Northeastern Iowa Power Company on the Cedar River is the first one in this section designed for automatic operation.

Two turbine units are installed, each being complete with all modern controls. It is expected that the plant will operate automatically as soon as water conditions permit, a 19-ft. head being normally available.

Waste and flood waters are to be discharged under automatic gates. A tunnel runs under the dam from the power house to the gate head, admitting water to the turbine casings.

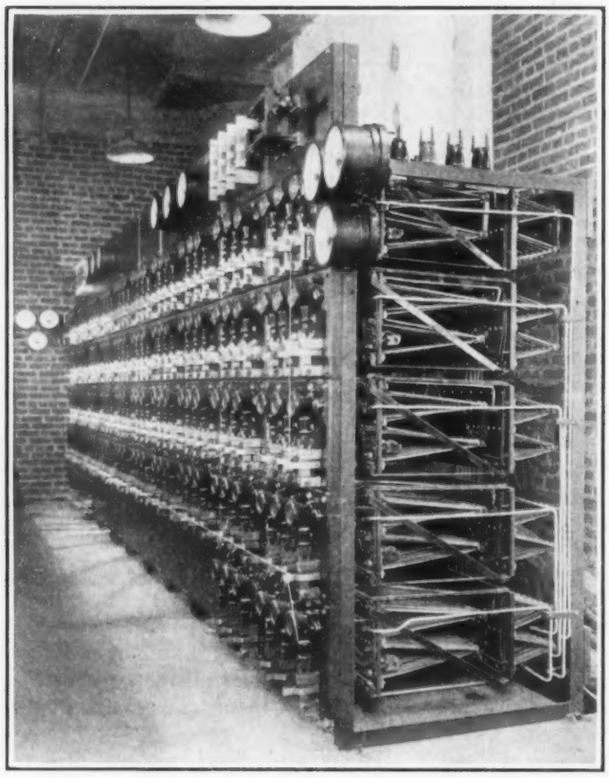


SMALL AUTOMATIC HYDRO PLANT INSTALLATION ON CEDAR RIVER IN IOWA

Commercial Activities and Public Relations

Simplified Charging Equipment Installed by Utility

THE installation of charging equipment at the New York Edison Company's 41st Street garage and service station building is interesting because of its space economy, simplicity of operation, ruggedness of equipment and flexibility. The charging board consists of 132 100-amp. circuits with extra space provided for eighteen additional circuits when required. For simplicity of operation and economy of installation it was decided to run a common neutral circuit throughout the garage and bring only single lines back from each charging station to the switchboard. This permitted the use of single-pole knife switches for control instead of a two-pole type of knife switch. It was thus possible to reduce the space required for each circuit by about a third over that required by any other arrangement.



COMPACT DESIGN OF BATTERY-CHARGING EQUIPMENT REDUCES SWITCHBOARD SIZE ONE-THIRD

Inasmuch as the New York Edison Company is using both the alkali and acid types of batteries, a rheostat was developed that would give the high charging rate required for the alkali type and the low finishing rate required for the acid type of battery. The single-pole knife switches were equipped with auxiliary contacts so that a battery ammeter reading could be obtained on a common set of instruments without necessitating the opening of the charging circuit.

The voltmeter reading is obtained by means of a specially designed push-button. Each circuit is numbered and a pilot lamp shows when the battery is put on charge and is being charged. The board is divided into two equal sections and is fed from separate feeders. It is possible to use one-half of the board while leaving the other half clear for repair work. Meters are installed on a feeder circuit in such a manner that the load is shown on each side of the three-wire system, and a meter is also installed in the neutral to show the unbalancing. This arrangement of meters permits the operator to keep a close balance on the two sides of the three-wire system.

First-Aid Drill Every Week

BY N. E. EMMONS
Utica Gas & Electric Company, Utica, N. Y.

EVERY Friday afternoon the maintenance department of the Utica Gas & Electric Company holds a safety session, including resuscitation drills and occasional lectures on safety measures, particularly those applicable to the work in hand.

It is believed by those in charge that in a large measure the individual called upon to render aid in an emergency must carry on almost as an automaton. The theory is that the workman, momentarily stunned by a personal reaction to a mishap, may lose those early, invaluable moments so necessary to the effectiveness of first-aid measures of resuscitation, unless his actions become almost involuntarily systematic under such circumstances.

Constant drill is expected to produce in the men a state of mind that will assert itself in the form of an intelligent and orderly procedure of first aid in the face of even the most unsettling type of accident that may occur.

Further than this, the weekly reemphasis of safety measures tends to keep the men at a uniform alertness.

Protecting Deserving Employees

PROTECTION of deserving employees without sacrificing business efficiency is a problem confronting all companies that have any concern for employee morale and also those companies that might be considered to be leaning backward in protecting employees to the detriment of business efficiency. But the principles to apply are often difficult to determine, as the conditions involved are frequently conflicting. Furthermore, situations may arise to which no preconceived plan is applicable, particularly if the company concerned is young in years of existence.

Asked for some of the principles which the Public Service Company of Northern Illinois applies in handling this problem, Britton I. Budd, president of the company, replied:

"It is rather difficult to answer your question properly, for the reason that oftentimes situations arise that are not applicable to any plan devised by us. These cases must be dealt with individually. Furthermore, our company is a rather young company. The average age of our regular employees is 32.9 years. Out

of 4,600 employees we have but 113 men in service more than twenty years, 46 of whom are under 50 years of age and only 21 are past 60 years. You can see, therefore, that our experience with this problem is somewhat limited.

"However, it has been our experience that there are three things of major concern to every man or woman earning a livelihood, especially if he or she has any dependents.

" 'What will happen if I am unable to work on account of sickness and am deprived of my usual compensation?' is one vital question. For this purpose we have an Employees' Benefit Association, which makes liberal provisions to employees who are sick.

" 'What will happen when I become too old to work?' is another question of concern to employees. Our Service Annuity system provides annuity for life to retired employees. This means that such an employee receives 1½ per cent of his pay for each year of service, based on the average rate of his highest five years of pay.

"In this connection I want to point out that at the present time there are 21 employees working for us who are eligible for retirement. Once each year we get in touch with each employee who is eligible for pension to see if he wants to be retired and also with his department head to see if he recommends retirement of the employee. In nearly every case the employee and the department head agree that the employee should continue to work another year, and this usually continues until the employee and the department head both seem to realize the advisability of retirement.

"The third problem confronting the wage earner is, 'What will happen to my dependents in case of my death?' The insurance plan that we have in effect helps to dispel this last worry.

"In addition we have also inaugurated various thrift plans, designed to encourage the employees to save systematically, and these help materially to increase their independence and to maintain their peace of mind, which naturally is reflected in their service to the company."

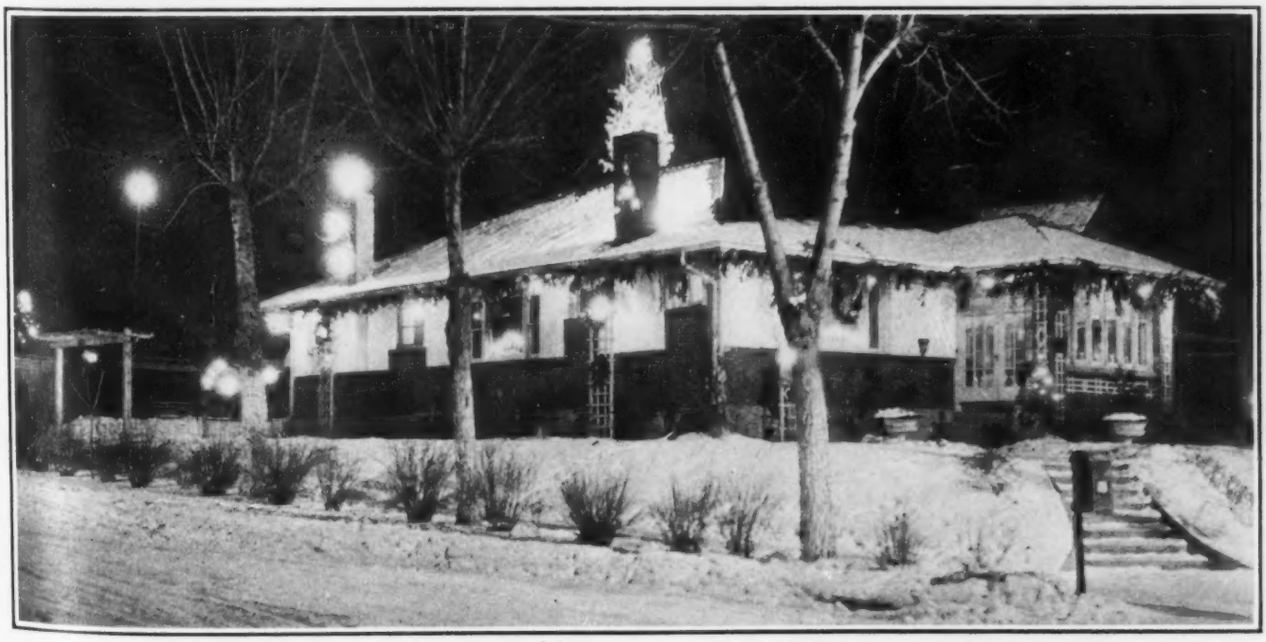
Electric Lights Spread Christmas Cheer

THE idea of spreading Christmas cheer by the use of electric lights was most successfully promulgated in Salt Lake City during the past holiday season by a lighting contest directed by the Electrical League of Utah in conjunction with the Salt Lake *Telegram*.

The residential district of the city was divided into three zones, with a set of equal prizes for each zone, a total of ten prizes being awarded in each section. The rules provided that these prizes should be awarded for the best electrically illuminated Christmas display, each display to be visible from the street and to be lighted each evening from Dec. 24 to Jan. 2, inclusive, during the period from dusk until 9:30 p.m.

Apartment houses were also included, in a special classification, one award being provided for the best display of this class. Likewise a special classification was provided to cover the downtown business section, three awards, in the form of trophy cups, being given to the best window or Christmas tree display made by merchants, classified as to foot frontage. This served to augment

THIS WAS NOT A PRIVATE RESIDENCE, SO WAS AWARDED A SPECIAL PRIZE FOR ITS EXCEPTIONALLY ATTRACTIVE DISPLAY



THIS BEAUTIFULLY ILLUMINATED RESIDENCE TOOK THE GRAND SWEEPSTAKES PRIZE IN THE CONTEST

a downtown Christmas decoration program launched by the city's Chamber of Commerce, which included the placing of alternate red and green covers over lights in the White Way system, the placing of hundreds of large Christmas trees in sockets along the curb and the hanging of wreaths at intervals on wires stretched along a number of the business streets.

The general program was in charge of the exhibits and displays committee of the Electrical League of Utah. There were many hundreds of displays, and their variety, originality and brilliance awakened widespread admiration.

Open House in Milwaukee Draws 100,000 Visitors

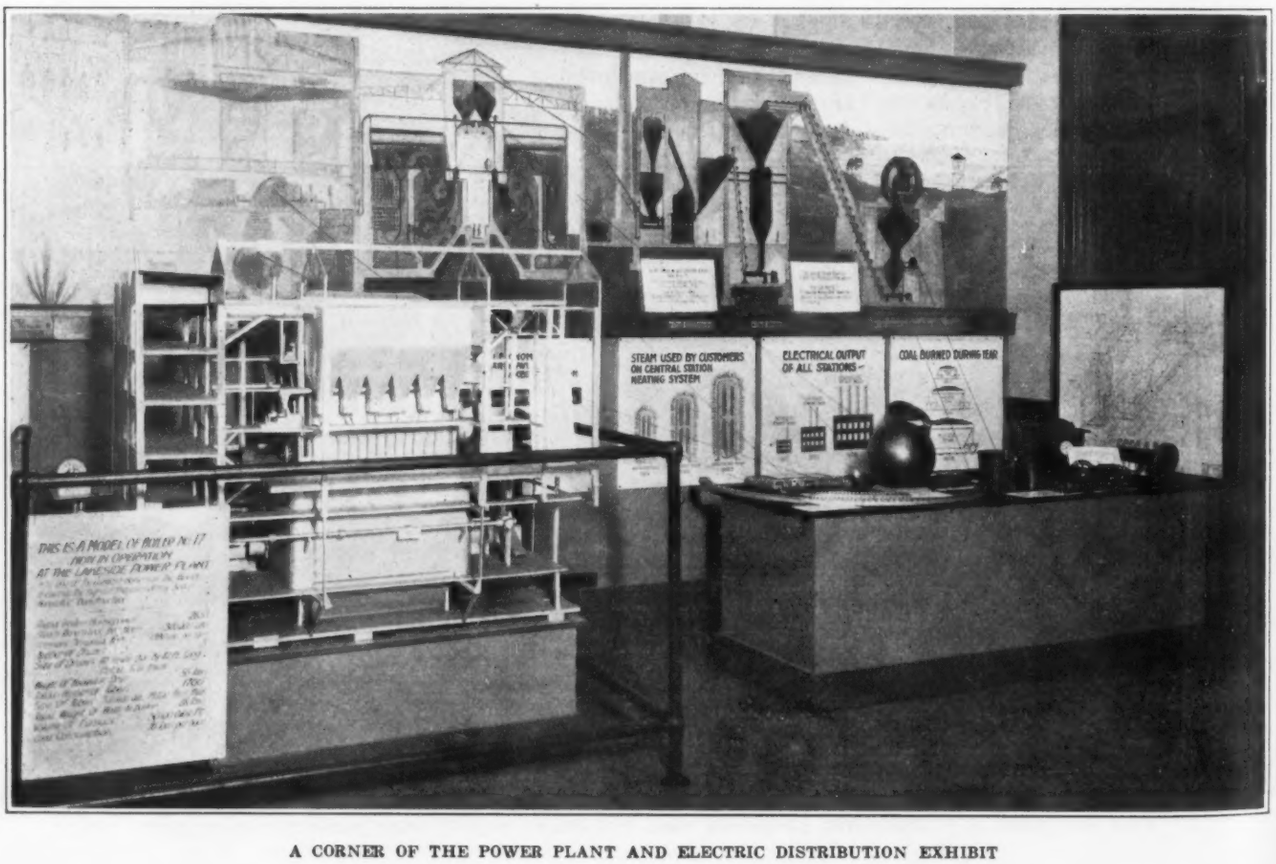
THE "open house" idea, which was conceived as a means for acquainting the general public with the functions and processes of public utilities, has proved very effective for this purpose, according to the Milwaukee Electric Railway & Light Company. Nearly 100,000 persons responded to the company's invitations in one week. Instead of merely inviting citizens to come and see how the human and mechanical functions are performed and then depending on guides who sometimes display their own ignorance when questions interrupt their stereotyped explanations, the Milwaukee company set aside different days for different groups, provided exhibits and expositions of various functions, from securing capital down to receipting a customer's bill, and afforded inspection trips through any part of the company's city system.

Formal opening of the company's new electrical merchandise headquarters housing a permanent electric home and the starting of a new 37,000-kw. station addition involving a 1,200-lb. pressure boiler afforded two features for open-house week.

The open-house period was started on a Thursday with a dinner given to city officials, civic leaders and newspaper men to the number of 250 in the auditorium of the public service building. The diners were given a preview of the exhibits that had been arranged and were shown a motion picture, "Where Jimmie Works," the scenario of which was written by G. W. Van Derzee, vice-president and assistant general manager of the Milwaukee company.

The next day was "employees' day." A total of 4,780 employees and their families visited the exposition. In response to direct invitations, 9,479 stockholders attended the following day. Although Sunday was not in the open-house calendar, several hundred people visited the plants and substations. Beginning Monday, the house was opened to the general public. The first day 7,757 people were counted entering the service building, 5,070 on the second, 8,221 on the third, 8,525 on the fourth, 8,523 on the fifth and 6,963 on the sixth, making a total of 59,568. This figure does not include visitors to plants, stations, shops, etc., all of which were open during the week. In addition, 31,669 persons visited the permanent electric home exhibit of the new-merchandise headquarters.

The exhibits in the public service building included general system conditions, financial structure, the story of electric service from coal pile to customer, radio interference and the functions of the Employees' Mutual Benefit Association. All of these functions and others were shown graphically by models or by actual demonstration in most ingenious and interesting ways.



A CORNER OF THE POWER PLANT AND ELECTRIC DISTRIBUTION EXHIBIT

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Automatic Regulator.—D. I. BOGEN.—For many years it has been common practice to set the vanes of water-wheels in accordance with the existing load on the turbine by the intermediate action of a piston and cylinder actuated by oil under pressure. This so-called "servo-motor" principle has been brought to a high degree of precision, and almost all modern water turbines utilize it in their regulating mechanism. The excellent results attained through this method of actuating a regulator prompted its recent adaptation to electrical regulators to influence voltage, current, energy or excitation. A delicate and finely adjustable oil valve, acted upon by an electromagnetic solenoid, admits oil under pressure above or below a piston which drives the regulator directly or over a sprocket chain. A very slight motion can thus be made to control a comparatively heavy mechanical drive. The actual model contains in a compact unit the electric valve relay, a small motor, an oil pump and the servo-motor proper. An esential part of the mechanism is a compensating device which prevents overregulation or hunting by resetting the main valve to its normal position. In addition to the above-named duties, such a device can also be adapted to the drive of induction-voltage regulators and to electrode adjustment on electric arc furnaces. — *Elektrotechnische Zeitschrift*, Nov. 18, 1926.

Turbine-Blade Materials. — According to the author of this article, the original material used for turbine blading was brass containing 71.9 per cent copper, 28 per cent zinc and 0.1 per cent lead. The tensile strength of this material fell as the temperature increased, and its resistance to fatigue deteriorated even more rapidly. Its breaking strength under load was less at high temperatures than was indicated by the ordinary tensile tests, and the material also suffered from an increase in the crystalline size as the temperature rose. Where the brass was too soft the surface was rapidly washed away by the steam, while if it were too hard there was a tendency to crack and ultimately to break. Further than this, it appears that it could only be used satisfactorily with temperatures not exceeding 200 deg. C. Nickel-bronze containing 50 per cent copper, 40 per cent zinc and 10 per cent nickel was also used, while other materials employed were a nickel-copper alloy and monel metal. The latter usually has a composition of 67 per cent nickel, 28 per cent copper and 5 per cent iron. It has been very extensively employed. Conclusions drawn from consideration of the numbers of materials used over the period of years during which turbine blades were being developed to their present state of perfection were that the blading material must be judged by its non-corrodibility, resistance to erosion, strength, convenience of manufacture and cost. Owing to increasing steam pressures and the higher speed at the low-pressure ends, erosion tends to proceed more rapidly than hitherto. The use of steam with a high degree of superheat necessitates that the blading at the high-pressure end shall be of a material which retains the necessary mechanical properties at the full temperature of the steam, while the high peripheral speeds of long blades at the exhaust end demand high tensile strength. At the high-pressure end of the turbine blades are also subject to mechanical fatigue at high temperature, so that a heat-resisting steel is obligatory. The development of a satisfactory blading material has also been found to depend upon its resistance to vibration or to repeated or reversed stresses.—*Electrician (England)*, Dec. 3, 1926.

Generation, Control, Switching and Protection

Action of Impulse Waves Upon Transformers and Reactors. — L. KOPEC.—The electric stresses in windings under the influence of impinging waves become of great importance when these waves are of impulse character; that is, when their shape is abrupt or steep. Mathematical investigations of this problem are difficult, for which reason simple test methods have been developed which give valuable data concerning these stresses under the action of sustained impulses. With this assumption the author gives an elaborate, highly mathematical treatise on the subject, investigating first the action of the initial impulse and explaining the influence of the mutual capacity between phases. Considering then the voltage distribution after the first impulse, the shape of the wave has to be taken into account. Particularly steep waves result at percussive voltages of between 1,000 and 9,000. If the given formulas are applied for longer lines, the time delay and the damping effect must be considered. The action of the traveling waves may be conceived as the combined effect of the individual harmonics, which permits the use of the original equations found by K. W. Wagner. All the equations given do not take into consideration the effect of possible reflection.—*Elektrotechnik und Maschinenbau*, Nov. 14 and 21, 1926.

Transmission, Substations and Distribution

Recent Progress in Distribution Practice.—J. F. FAIRMAN and R. C. RIFENBURG.—Changes in the transmission and distribution system of the Brooklyn Edison Company during the past four years are briefly described, and mention is made of the effect of these changes on the system's efficiency. The plan of development is described in detail and unique features of the system are described. Mention is made of the ultimate plan of interlacing the high-tension feeders to reduce the overload on transformers, to maintain good voltage regulation with one feeder out of service and to pick up overload in areas of different load characteristics to obtain the advantage of diversity. It is shown that this plan of development insures better service to the customer from every point of view, makes for safer working conditions on the system, results in general system improvement and involves less total investment as well as a considerable reduction in losses and operating costs. The appendices to the article describe tests made to determine whether arcing and short-circuit faults in the network will be self-clearing, the permissible voltage fluctuations on incandescent lamps and the dissipation of heat from transformer vaults.—*Journal of A.I.E.E.*, January, 1927.

Overhead-Line Calculations.—BLONDEL and DROUVILLE.—The first part of this paper covers theoretical considerations for the mechanical layout of overhead lines, taking into account the temperature, the wind pressure and snow loads upon wires. The results are arranged either in tabulations or in generally applicable alignment charts. The second part deals with the electric characteristics of lines, giving also theoretical and graphical means for quick determination of correct size and most economic wire cross-sections for any given conditions. — *Revue Générale de l'Electricité*, Nov. 20 and 27, 1926.

Units, Measurements and Instruments

A Continuous Integraph.—V. BUSH, F. D. GAGE and H. R. STEWART.—A mechanical integraph has been developed which plots continuously the integral of the product of two functions. It uses the principle of the electrical integrating watt-hour meter combined with a moving table. Errors of the machine have been reduced to an average of 1 per cent for common uses. By cross-connecting the device in a simple mechanical way it is possible to solve certain types of integral equations. A link motion has been added which plots the product of two given functions. Various uses have been made of the instrument for solving problems in connection with electrical circuits, continuous beams, etc., and certain problems involving integral equations.—*Journal of the Franklin Institute*, January, 1927.

X-Ray Tests of Metals.—G. SACHS.—The use of X-rays in metallurgical investigations plays today an important part in the laboratories of manufacturing concerns, because it is the only method known to disclose with certainty internal irregularities of finished or half-finished metal products. By means of straight or polarized X-rays the investigator is not only able to determine the solidity of cast or forged metal or alloy parts, welds, etc., but also, owing to the fact that altering of the molecular structure produces a changed pattern of the X-ray reflection picture, mechanical stress within metals can thus be detected. Methods are described of Laue and Debye, who developed this X-ray diagnosis to a high degree of perfection. Present

equipments disclose air pockets of less than ⅛ in. in layers of steel 4 in. thick. Modern X-ray apparatus with high-voltage transformers and vacuum-tube rectifiers are described. — *Zeitschrift des Vereines Deutscher Ingenieure*, Dec. 4, 1926.

Illumination

Lighting of Railway Classification Yards. — GEORGE T. JOHNSON. — This paper deals primarily with the illumination of modern large classification yards of the hump type in which the traffic is in one direction only. Flood-lighting is advocated as the most generally satisfactory system, and various arrangements to meet the different conditions of yard layout, space available, etc., are described.—*Journal of A.I.E.E.*, January, 1927.

Electrophysics, Electrochemistry and Batteries

Voltage Studies in Copper Refining Cells.—COLIN G. FINK and C. A. PHILIPPI.—Anode and cathode polarization and *IR* drop through the copper electrolyte were determined under varying conditions of temperature and composition of electrolyte. Results indicate the importance of studying and controlling the voltage at both cathode and anode surfaces and not merely considering the *IR* drop through the electrolyte, as has been common practice in the past, to arrive at the most efficient refining operating conditions.—*American Electrochemical Society*, Oct. 11, 1926.

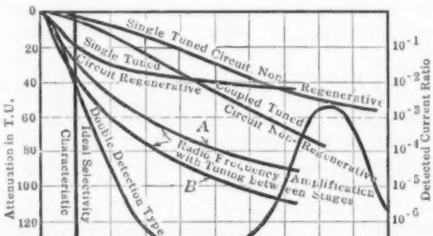
Motors and Control

Electric Drive of Large Refrigerators.—D. I. GANSAUGE —Basing his observations upon modern German and American operating experiences, the author discusses at length the relative merits of synchronous and asynchronous three-phase motors for the drive of compressors for large refrigerators. While it is common practice in America to provide a synchronous motor for this service it is pointed out that this type of motor has characteristics of less desirable nature than the induction motor used abroad. Its overload capacity is low, its starting current is very high, its physical size is two and three-quarters times greater, and its efficiency is lower. The author devotes the second part of this article to a detailed description of the latest types of synchronized induction motors, which he claims are much superior for this particular drive. The greatest disadvantage of the common induction motor is its poor power-factor performance. This has been completely overcome by adding a so-called three-phase exciter unit to the main motor. Various methods to accomplish this auxiliary excitation are explained in detail.—*Siemens Zeitschrift*, October and November, 1926.

Double Crane for 120-*Ton Load* —E. ALTSCHUL.—A repair shop of the Swiss Federal Railways installed recently a traveling crane consisting of two units, each designed for a 60-ton load, the two units being mechanically connected and operated from one cab. Each unit carries two winches, this resulting in four hooks, of which each pair lifts one cross-spreader. Exceedingly delicate control was required, for which reason the manufacturer decided upon direct-current drive. The existing three-phase supply is changed into direct current by a six-unit Leonard set, driven by a 105-kw. induction motor, installed on one of the crane girders. The main hoist motors of 37 kw. intermittent output permit a perfectly smooth regulation of the lifting speed from 4/10 m. to 2 m. a minute. For lowering a heavy load regenerative braking is provided. Should the main power supply fail during the lowering period, a centrifugal switch cuts the entire equipment off the lines and applies emergency brakes.—*Brown, Boveri Mitteilungen*, December, 1926.

Telegraphy, Telephony, Radio and Signals

Radio Broadcast Coverage of City Areas.—LLOYD ESPENSCHIED.—This is an abridgment of the original article. Radio broadcasting involves a system of electrical distribution in which dependent relations exist between the transmitting station, the transmitting medium and the receiving station. In this article the attenuation and fading which attend the spreading out of broadcast waves are considered. A field-strength contour map is given of the measured distribution of waves



SELECTIVITY CHARACTERISTICS OF RECEIVERS HAVING DIFFERENT TYPES OF CIRCUITS

broadcast by station WEAF over the New York metropolitan area. A rough correlation is given between measured field strengths and the serviceability of the reception in yielding high-grade reproduction. The question of the preferred location of a transmitting station with respect to a city area is considered. It is shown that an antenna installed upon a tall building may radiate poorly at certain wave lengths and well at others. Surveys are presented of the distribution effected by an experimental transmission station in each of several suburban points. Finally there is considered the relation which exists in respect to interference between a plurality of broadcast transmitting stations operating in the same service area. The importance of high selectivity in receiving sets is emphasized and the measured selectivity characteristics for samples of a number of receiving sets are noted.—*Journal of A.I.E.E*, January, 1927.

Load-Carrying Capacity of Amplifiers.—F. C. WILLIS and L. E. MELHUISH. — This paper describes the adaptation of the cathode-ray oscillograph to the determination of the overload point of vacuum-tube amplifiers. Using the input voltage to produce a horizontal deflection and the output voltage or current to produce a vertical deflection, the amplier performance is readily determined by noting the resulting figure on the fluorescent screen. So long as the figure is virtually a straight line or an obviously undistorted ellipse, it is found that the amplifier output is free from harmonics. As soon as overloading begins the oscillogram shows either a sharp bend at either or both extremities of the line or apparent distortion of the elipse. According to the author, the method has the particular advantage of being quick.—*Bell System Technical Journal*, October, 1926.

Miscellaneous

Torsional Vibration of Shafts and Shaft Systems. — ROBERT LOCHNER. — Problems of torsional oscillation frequently arise in the various branches of engineering. The investigation of four and more masses is involved and calls for a considerable expenditure of time. In this paper the general theory of torsional operation is first reviewed and a method is then evolved by which the investigation of any number of vibrating masses is considerably simplified. An example is added to the article to illustrate the application of the method as brought out by the author.—*Journal of Institute of Electrical Engineers* (*England*) December, 1926.

Electrical Characteristics of Spark Generators for Automotive Ignition.—R. B. BRODE, D. W. RANDOLPH and F. B. SILSBEE.—This paper reports the results of a program of measurements on eleven ignition systems differing widely in type. The results serve primarily to give representative data on the electric and magnetic constants of such systems and on the secondary voltage produced by them under various conditions of speed, timing, shunting resistance, etc. They also serve to confirm certain of the theoretical formulas which have been proposed to connect the performance of such systems with their electrical constants and to indicate the extent to which certain simplified model circuits duplicate the performance of the actual apparatus. —*Report No.* 241, *National Advisory Committee for Aeronautics*, 1926.

Electric Church Clock. — K. LEOPOLDSBERGER — The old mechanical clockwork on one of Vienna's cathedrals was recently replaced by up-to-date electrical equipment which not only operates a large clock but also strikes on two sets of bells the quarters, halves and full hours. A precision pendulum clock, wound electrically at certain intervals, gives impulses every minute which turn the hands on the clock face. Every fifteen minutes an auxiliary circuit is closed, starting one or the other of two motor-driven bell strikers at intervals corresponding to the time announced. The striking mechanism is essentially a small direct-current motor which drives over a worm gear a spiral cam with a sudden drop-off. A pawl operates small hammers which strike against the outer rim of the bells.—*Siemens Zeitschrift*, October, 1926.

News of the Industry

Coolidge Declines Award

Invalidation in Federal Court of Patent on Ductile Tungsten Leads Him to Refuse Edison Medal

THE Edison Medal for 1926, which was awarded in December to Dr. William D. Coolidge, assistant director research laboratory, General Electric Company, "for the origination of ductile tungsten and the fundamental improvement of the X-ray tube," has been declined by Dr. Coolidge for the reason given in the following letter:

SCHENECTADY, JAN. 17, 1927.

MR. GANO DUNN, chairman Edison Medal Committee, American Institute of Electrical Engineers, New York City.

MY DEAR MR. DUNN: Judge Morris has just handed down a decision to the effect that my ductile tungsten patent is invalid. This decision, coming from a man of Judge Morris' standing, proves to me that the best of men could question my right to the Edison medal which your committee has been good enough to award to me.

My appreciation of that great pioneer Mr. Edison, in whose honor the medal was established, and my admiration for its former recipients are such that I would not, for the world, do anything that could in any way detract from the luster of that medal, which should stand for generations to come as one of the most coveted prizes for meritorious work in the electrical field.

In the light of the above facts, I cannot accept the medal. Allow me to take this opportunity to thank you and the other members of the committee and to express my deep appreciation of the great honor which you did me. Very sincerely yours,

W. D. COOLIDGE.

At a specially called meeting of the Edison medal committee, held Jan. 21, it was resolved " . . . with profound regret, to acquiesce in the decision of Dr. Coolidge, which nullifies the award." There will, therefore, be no award of the Edison medal for 1926.

The legal finding referred to by Dr. Coolidge, made in the United States District Court of Delaware by Judge Hugh Morris two weeks ago, is abstracted under "Recent Court Decisions" in this issue of the ELECTRICAL WORLD (page 272). As there stated, the case was that of the General Electric Company vs. the DeForest Radio Company and the Robelin Piano Company, a suit charging contributory infringement in the manufacture and sale of radio tubes having ductile tungsten filaments, and the court held that the discovery of the cold ductility of the metal was not an invention and that therefore the patent was void. An unusual feature of the judgment was that by it Judge Morris reversed a former finding of his own, made when sitting in New Jersey, which upheld the patent. If his later decision stands, the effect it will have on lamp manufacture has become a subject of considerable interesting speculation.

One of the contentions of the defendants in the suit was that Dr. Colin G. Fink, head of the department of electrochemistry at Columbia University, New York, and a former associate of Dr. Coolidge's in the General Electric laboratories, was the real originator of the process in dispute. Dr. Fink himself made this claim and had protested to the Edison medal committee of the Institute against its award to Dr. Coolidge. In view of the finding that the patent was invalid, the court did not pass on the question of priority of discovery.

New York Now Has "Public Committee on Power"

The Committee on Coal and Giant Power which last year on several occasions sought publicity in the press for its views on public ownership, rates, holding companies and similar matters in which light and power companies have concern, but whose identity was not made clear beyond the assertion that it embraced a national group of economists, lawyers, engineers, labor leaders and business men, assumed a more tangible form last week when a Public Committee on Power was organized in New York City with Arthur Garfield Hays, a well-known lawyer, as chairman and Stephen Raushenbush as secretary. Colonel F. S. Greene, State Superintendent of Public Works, explained to the organization meeting the water-power situation in New York as he saw it, and general sympathy with Governor Smith's State Power Authority program was evinced by the fifty men and women present. The organization, it was announced, expects to distribute literature and to send speakers through the state to arouse sentiment in favor of this proposal and against the granting of water-power leases to private interests.

From the Tennessee to the Colorado

Controversy Over Water Power Goes on in Halls of Congress—Muscle Shoals Back in Committee, with New Bids—Delay on Upper River—Real Purpose of Boulder Dam

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

ACTION on Muscle Shoals at this session of Congress was made still more remote, in the opinion of many members, by the course of the House committee on military affairs in reopening the subject for consideration before disposition of the bill now on the House calendar. Although the purpose of the committee in instituting new hearings was to consider the revised offer of the American Cyanamid Company, it was in no position to bar testimony on behalf of the so-called Slemp offer. As this is written, most of the time of the committee has been taken up in hearing statements in support of the latter. Certified checks for a million dollars were laid before the committee by this company, whose offer is incorporated in a bill fathered by Representative Reece of Tennessee. C. Bascom Slemp, formerly secretary to President Coolidge, describes the project as "the best business proposition before Congress."

Government operation of Muscle Shoals plants has received a recruit in the person of Representative Snell of New York, chairman of the rules committee, who, in debating an unsuccessful motion directing the President to put the nitrate plant in immediate operation and to use for that purpose the money being received for the power, said, "I have about made up my mind that there is nothing left but a period of government operation, as much as we dislike that method of solving problems." Mr. Snell urged definite action at this session of Congress.

The revised offer of the Cyanamid Company was introduced by Representative Madden of Illinois, a former supporter of the Henry Ford bid. In advocating the new offer Mr. Madden said, among other things:

"The offer of the American Cyanamid Company, as set forth in the bill I have introduced, is a better proposal than Henry Ford's. The original offer of the Cyanamid company provided for the production of fertilizers containing 40,000 tons of fixed nitrogen, the same as Mr. Ford's offer, but under my bill the American Cyanamid Company agrees to produce fertilizers annually containing not less than 48,000 tons of fixed nitrogen, an increase of 20 per cent over the Ford offer, and this increase is equal to more than half of the fixed nitrogen contained in Chilean nitrates we imported in the year 1914.

"A single comparison between the Cyanamid offer and the proposal of the Associated Power Companies seems to me sufficient. The power companies propose to build a new nitrate plant at an estimated cost of from fifteen to twenty million dollars. The farmers must pay interest on this at the rate of about a million dollars a year and depreciation charges of about another million annually. In all the long record I know of nothing to indicate that by adopting a new process involving additional charges of $2,000,000 a year we will thereby be able to produce fertilizers more cheaply than by the use of our present plant. The farmers contend that Congress should not accept any offer that will unnecessarily add $2,000,000 a year to their fertilizer bills at Muscle Shoals, and in my judgment the farmers are right."

The military affairs committee apparently is divided as to the advisability of reporting out further Muscle

Shoals legislation, but the rule committee will force action on the project if it can. A delegation of officials and citizens of Tennessee is to be heard in opposition to the revised Cyanamid bill. There is strong opposition in Tennessee against a government dam at Cove Creek. This would deprive the state of taxable values and of the exercise of control over the development. In its new offer the Cyanamid company agrees to increase the amount of fertilizer that it will manufacture if the government will spend $50,000,000 additional on Cove Creek and Dam No. 3.

Upper Tennessee Report Withheld by Federal Commission

With Muscle Shoals thus pushed unexpectedly onto the carpet, the report on the upper Tennessee River which the Federal Power Commission was on the point of issuing has been withheld. The power resources of the upper Tennessee are greater than those of Muscle Shoals, and it is contended that the controversy over the government's project should not be allowed to halt progress in that region. It is argued that development there has been delayed for years by political influences. The first application on the upper Tennessee was filed in 1922. Action was delayed for three years waiting for the general survey of the river to proceed far enough to cover the upper portion. With all essential data at hand the Chief of Engineers of the army reported favorably on the plan of the East Tennessee Development Company. That report has been before the Federal Power Commission for several months and has been carefully studied. None the less, another year's delay is now feared by those most concerned.

Congressmen Learning Things About Boulder Dam

Pending the outcome of negotiations between the Colorado River basin states, the House rules committee has deferred action on a motion to give the Swing-Johnson Boulder Canyon dam bill preferred legislative status. Should the committee refuse to grant preferential status, there would be little likelihood of the bill coming before the House for action this session. The committee set no specific date for again taking up the subject.

After extended hearings on the Boulder Dam bill before the rules committee of the House of Representatives, several members of that committee apparently learned for the first time that the issue involved on the Colorado is as highly controverted as that on the Tennessee. Chairman Snell had heard of no opposition to the bill when it was first referred to his committee. The hearings had not proceeded long, however, until he had formed a different conclusion. The committee evidently attaches significance to the fact that flood control is an incident of the proposition and not the major point as some of the members had thought. It was quite firmly established that it is power legislation which is being considered.

Utah Rescinds Ratification

Withdraws from Six-State Colorado River Compact—Conference of Lower Basin States Resumed

AT THE urgent request of its congressional delegation in Washington, Utah has rescinded its ratification of the Colorado River six-state compact. Both branches of the Utah Legislature, which is now in session, passed the Auerbach bill providing for withdrawal last week, and it has been signed by Governor Dern. It is pointed out by supporters of the Auerbach bill, which met virtually no opposition, that the repeal of Utah's adherence to the six-state pact does not mean necessarily that it has been abandoned and that if it is determined later that the six-state pact and amended Swing-Johnson bill properly protect Utah's future in the Colorado River resources, the Utah Legislature will be in session for some time yet and could reconsider its action. The bill was passed as an emergency measure to forestall possible passage of the Swing-Johnson bill, which it was believed would be detrimental to Utah's interests.

The tri-state conference between commissioners of California, Arizona and Nevada reconvened in Los Angeles on Jan. 20. These commissioners are attempting to bring harmony into the discussion concerning the development of the Colorado River and the division of the waters and the power revenues of the lower river. The commission has been meeting for more than a year at intervals and this session is a continuance of the meetings which were held in Los Angeles during December. Charles P. Squires of Las Vegas, Nev., was again elected chairman.

A bill was introduced in the Nevada Senate on Dec. 19 to repeal that state's approval of the six-state Colorado River pact upon the ground that Nevada's interests are fully protected in the seven-state pact. Governor Balzar in a message to the Legislature declared his belief that the state's Colorado River commission should have authority to deal with other interested states in negotiation and settlement of the division of water stored and power developed from the proposed Boulder Dam.

Investment Bankers Oppose Swing-Johnson Bill

Opposition to what it terms an effort to engage the United States government in the electric power business was expressed by the board of governors of the Investment Bankers' Association of America at a meeting in Chicago last week, when a resolution condemning the Swing-Johnson bill was adopted. "While the measure is represented as primarily for flood control and reclamation on the Colorado River," the resolution says, "yet it involves government ownership and operation of a large power plant. The bill departs from the already established national policy contained in the federal water-power act for the handling of power questions by the Federal Power Commission. Full and adequate flood protection and water supply can be provided by construction costing much less than will be required to build the proposed high dam at Boulder Canyon."

Power Authority or No?

Question Again Before New York Legislature—Governor's Bill Differs from Previous Proposals

GOVERNOR SMITH'S bill to create a State Power Authority made its reappearance in the New York Legislature on Monday, being introduced by the minority leaders of the two houses. The bill differs in several respects from the measures introduced and rejected in previous years. It would set up a commission of three members to head a body perpetual in duration, capable of owning property, borrowing money and making contracts, to be known as the New York State Power Authority, such commissioners to receive no salary and to serve for seven, five and three years respectively, five years to be the normal future term. An appropriation of $250,000 is carried in the bill to enable the Power Authority to investigate the entire water-power situation and report to the Legislature of 1928 concerning the economic practicability of accomplishing development of state-owned power through its agency or otherwise. It would have power to negotiate with the Canadian government and the federal government and to subpoena and compel the attendance of witnesses.

The bill differs from those previously introduced in that it does not specifically repeal the present water-power licensing statute, containing instead the following clause:

"The provisions of the conservation law and every other law relating to the conservation department or commission, or the functions, powers or duties assigned to the Division of Water Power and Control by Chapter 620 of the Laws of 1926, shall, so far as necessary to make this law effective, be deemed to be superseded, and wherever the powers granted herein to the power authorities are deemed to be in conflict with prior provisions of law or are inconsistent therewith, the said prior provisions of law shall be deemed by this act to be modified or repealed, as the case may be."

The fate of the Governor's bill is in the hands of his Republican opponents, who control both branches of the Legislature. Their leaders declare themselves opposed to the repeal of the present statute and in favor of an immediate non-political investigation with a report to the present session of the Legislature. Conferences will be held in an endeavor to arrive at an agreement. Governor Smith is said to be confident that he will be able to convince the Republicans that the time has come for them to fall in line with his ideas, especially as the Legislature itself under his proposal will have the last word, the Power Authority being under obligation, after having worked out a plan, to come back for legislative sanction before it can do anything in the direction of its realization. He is said still to desire to make Owen D. Young the head of the body he desires to set up, supported by a financier and a legal authority.

Death of Anson W. Burchard

High Officer of the General Electric Company Succumbs in New York at Age of 61—Sketch of His Business Career and Tributes from Associates

SUDDEN death came last week to Anson Wood Burchard, vice-chairman of the board of directors and chairman of the executive committee of the General Electric Company and chairman of the board of directors of the International General Electric Company, who succumbed on Saturday afternoon, Jan. 22, to acute indigestion at the home in New York City of Mortimer L. Schiff, with whom he was lunching. Mr. Burchard was in his sixty-second year.

Mr. Burchard was a native of Hoosick Falls, N. Y., and was born on April 21, 1865. After graduation from the high school there, he entered Stevens Institute of Technology, where he was graduated in 1885 with the degree of mechanical engineer. His first employ was with the J. M. Ives Company, a steam and general factory engineering firm at Danbury, Conn. In 1891 he became treasurer and manager of the T. & B. Tool Company of Danbury, where he remained until 1900, when he became vice-president of the Cananea Consolidated Copper Company, operating mines at Cananea, in the State of Sonora, Mexico.

After filling this post for two years, Mr. Burchard in 1902 joined the organization of the General Electric Company. Until 1904 he was comptroller, with headquarters at Schenectady. In that year he was named assistant to the president, in 1912 he was elected vice-president, and in 1917 he was made a member of the board of directors. In May, 1922, he was elected vice-chairman of the board, and in June of the same year he was elected president and chairman of the board of directors of the International General Electric Company. About a year ago he was relieved of the duties of president but continued as chairman of the board.

Mr. Burchard's counsel was often sought by numerous interests outside the immediate sphere of his activity, particularly in the field of electric power development, abroad as well as in this country. He was regarded by his associates as a man with a superior degree of executive ability and a broad administrative vision cultivated by his years of experience. In cooperation with the late Charles A. Coffin, founder of the General Electric Company, he laid out a policy of development of the financial resources of electric public utilities, enabling them to arrange credits and buy more easily, and thereby stimulated the expansion of the industry. He was also active 20 years ago in the consolidation of the many manufacturing units of the General Electric Company, such as the Stanley Electric Company, the Fort Wayne Electric Company, the General Incandescent Arc Lighting Company, the Northern Electric Company and the Sprague Electric Company. He was a director of several utility and electrical companies and a member of many electric and power clubs and organizations, including the A.I.E.E. and the A.S.M.E. He leaves a wife, who was Allene Hostetter, and a sister, Mrs. Hinsdill Parsons of Schenectady.

Funeral services were held at Mr. Burchard's late home, 690 Park Avenue, New York, Tuesday morning, Jan. 25, and burial took place at Locust Valley, L. I. Among those present at the funeral services were Owen D. Young, George P. Baldwin, C. C. Chesney, Gano Dunn, John W. Lieb, H. H. Barnes, H. A. Kidder, L. A. Osborne, E. W. Allen, C. H. Minor, M. A. Oudin, A. S. Durrant, Matthew C. Brush, S. Z. Mitchell, James H. McGraw, Jr., Irving Brokaw, B. E. Sunny, H. L. Monroe, F. L. Higginson, Thomas N. McCarter, George D. B. Green, H. M. Addinsell,

A. W. BURCHARD

E. N. Hurley, Fairfax Landstreet, Philip Gossler, H. Hobart Porter, Frank C. Humphrey, Theodore B. Starr, George T. Bishop, E. J. Belknap, Percy M. Chandler, Charles W. Neave, W. H. Onken, Jr., Percy Young, Walter Wells, S. Doane, Matthew S. Sloan, Nicholas F. Brady, Dwight W. Morrow, Seward Prosser, General J. G. Harbord, David Sarnoff, Clement Studebaker, F. L. Dame, Lucius R. Eastman, Frank N. Tate, Edwin Gruhl, E. M. Herr, J. H. Pardee, Mortimer Schiff, Arthur Williams, Clarence Dillon, C. W. Appleton, L. P. Sawyer, A. G. Davis, W. W. Freeman and W. R. Burrows.

TRIBUTES FROM COLLEAGUES

Owen D. Young, chairman of the board of the General Electric Company, said: "Through his long associations with the company Mr. Burchard had become very familiar with its business in all of its branches. His loyalty to the company and his pride in it, his devotion to his associates and his wide interest in all good causes made him universally respected and loved. His loss to all of us will be very great and is deeply felt."

Gerard Swope, president of the General Electric Company, who is in Spain, sent the following radiogram: "The General Electric Company loses a patient, loyal and able executive of the highest type, the electric light and power industry a man of vision and courage, and I lose a friend who had my admiration, respect and affection."

Clark H. Minor, president of the International General Electric Company, said: "The sudden death of Anson W. Burchard is a great shock to his associates and a host of friends in the international business world. His wide counsel and his splendid enthusiasm will always be missed. Throughout his long and successful career with the General Electric Company he maintained a deep interest in foreign markets. Mr. Burchard was influential in bringing about the organization of this company. He was an outstanding leader and executive in the business world. A man of wide experience and broad views, interested in the welfare of mankind, he was respected by all and dearly loved by his associates."

Dwight W. Morrow, member of the board of directors, said: "We have lost a dear personal friend and the company has lost a loyal and devoted leader."

Sir Hugo Hurst, General Electric Company, Ltd., England: "He endeared himself to all who met him. I feel with you the loss of a great friend. The world will miss his great heart and delightful personality."

Other tributes follow:

Nicholas F. Brady, president New York Edison Company: "The death of Mr. Burchard is a great shock to us all in the public utility field, who held him in high regard as a far-sighted, courageous and able friend of our business."

Samuel Insull, president Commonwealth Edison Company, Chicago: "Mr. Burchard's death will be a great loss to the electrical industry."

James H. McGraw, president McGraw-Hill Publishing Company, Inc.: "He has accomplished great things in the industry, and as a man he possessed rare and admirable qualities. He will be missed by a large number of admirers and friends throughout the country."

Elbert H. Gary, of the United States Steel Corporation: "He was an able and faithful associate in business and left a host of friends. I entertained for him feelings of great respect and admiration."

General G. E. Tripp, chairman board of directors Westinghouse Electric & Manufacturing Company: "He was a leader of men and his loss will leave a vacant seat among the wise counselors of the day."

Alfred E. Waller, managing director National Electrical Manufacturers' Association: "In common with the electrical industry, the membership of our organization feels a personal loss."

Dr. T. Dan, Mitzui Company, Japan: "Profoundly shocked by sad news. Please accept my sincerest sympathy for yourself and your association for irreparable loss you have sustained."

R. F. Pack, president National Electric Light Association: "The entire electrical industry has lost one who thoroughly understood its problems and was in sympathy with its aspirations."

California Edison Appeals

Five Reasons Advanced for Rehearing of Herminghaus Case, Which Involves Riparian Law

CONTENDING, generally, that an adverse decision on Dec. 24 last (see ELECTRICAL WORLD for Jan. 1, page 71) jeopardizes the entire future of hydro-electric development in California, the Southern California Edison Company on Jan. 13 filed a petition in the Supreme Court for a rehearing of the Herminghaus case. The matter specifically involves waters of the San Joaquin River, but affects also the remarkable hydro-electric potentialities developed by the Southern California Edison Company at its Huntington Lake project. Amelia Herminghaus and others brought action seeking the right, as riparian owners, to the full flow of the San Joaquin for use in flooding their property to irrigate grass lands. The decision of the court last month, concurred in by all members except Associate Justice Shenk, upheld the Herminghaus contention.

In its application for rehearing the power company asserts that because of the vast importance of the decision to hydro-electric development the case should have further consideration. The application also cites that Associate Justice Sullivan concurred in the majority decision without hearing the original arguments last July.

Three other contentions are set forth. One is that Amelia Herminghaus knew of the Huntington Lake project as far back as 1912 but took no action in the matter. The second is that the Southern California Edison Company is likewise a riparian owner and as such is entitled to certain rights to San Joaquin waters as well as the complainants. The third is that the decision, as handed down, fails to cite a single case involving riparian owners on both sides, confining itself to citations involving riparian owners and appropriators.

Los Angeles Power Bureau Has Ambitious Program

The Los Angeles Bureau of Power and Light intends to push to completion during 1927 one of the biggest extension programs ever carried through by it in a single year. This was revealed recently when officials of the bureau pointed out that budget allotments for the next twelve months call for a total investment of $12,650,000 in enlargements and additions to the Power Bureau's generating and distributing facilities.

One of the most important features of this construction program, Chief Engineer Scattergood says, will be the erection and equipment of a standby steam generating plant. This plant, which is planned for an initial generating capacity of about 25,000 kw., is to be erected in the harbor district and will cost approximately $3,500,000, including buildings and generating units. This is the steam-plant installation which has caused the Southern California Edison Company to file an injunction suit seeking to restrain its construction on the ground that it would be a direct violation of the agreement made when the city purchased from the company all electrical distribution lines within the Los Angeles city limits.

Ranking next to the steam plant, on the basis of money to be invested, comes the Power Bureau's continuation of the construction of a 110,000-volt transmission line from its central receiving station on North Main Street to the harbor district. This work, including the cost of new receiving stations, will require an investment of $3,200,000. Additional generating units are also to be installed by the Power Bureau in two of its hydro-electric plants along the aqueduct at a cost of $1,200,000, while extensions and enlargements costing approximately $4,500,000 must be made to the bureau's distributing system. Miscellaneous investments are put at $500,000.

Seattle Asks Federal License for Skagit Extension

The city of Seattle on Jan. 22 filed with the Federal Power Commission an application for a license covering its Skagit River development. The application for a preliminary permit, filed Nov. 3, was granted only recently. According to the data submitted, the Ruby Dam, for which authorization is sought, will produce a reservoir of 3,500,000 acre-feet capacity. The head would be 445 ft. and the primary capacity 83,000 hp. It is planned, however, to install six 54,000-hp. units. The Diablo Dam, forming part of the project, will back up the river to the Ruby Dam. Its capacity is calculated as 90,000 acre-feet, the head which would be developed is 320 ft., and the primary capacity is estimated at 108,000 hp. Six 47,000-hp. units would be installed there. The Gorge Dam will create a reservoir holding 6,000 acre-feet. This water is to be used in the existing Gorge power plant. The primary capacity there is 150,000 hp. At present 75,000 hp. is installed. The ultimate installation, however, plans to make use of eight 37,500-hp. units.

According to a recent article in the Seattle *Times*, the existing tunnel intake at the Skagit River plant has proved defective owing to its faulty position, which permits the ingress of gravel and débris in great quantities, and both this intake and the present dam will have to be discarded and new ones built further up the river at a cost of from $2,000,000 to $4,000,000 additional.

Full Program for National Lighting Equipment Men

With advance reservations which numbered more than 800 ten days before the opening of the National Lighting Equipment Exhibition at the Hollenden Hotel, Cleveland, to be held from Jan. 31 to Feb. 5 inclusive, the joint convention of lighting associations promises to be an outstanding success. This exhibition is also the occasion for conventions of the National Association of Lighting Equipment Dealers, Artistic Lighting Equipment Association, Illuminating Glassware Guild, Associated Lighting Equipment Salesmen, A.C.E. Division, and the Association of Electragists International.

Among those announced to speak at one or another of the various meetings are E. W. Hook, O. A. Barber, Robert Johnson, W. Feuillan, Jr., J. X. Netter, Preston S. Millar, Paul W. Jenkins, Fred R. Farmer, S. G. Hibben, J. W. Schulze, G. J. Klein, M. D. Blitzer, F. L. Scott and Laurence W. Davis.

California Engineers Meet

Grounds, Water Hammer, Accident Prevention, Meter Testing, Distribution Practice and Other Topics

THE midwinter meeting of the Engineering Section of the Pacific Coast Electrical Association, held at the Fairmont Hotel, San Francisco, Jan. 12-14, was well attended and contributed much in the way of discussion and experience to aid in the solution of operating problems of the industry.

Enthusiastic committee discussion on the subject of grounds brought out a majority sentiment in favor of common grounds for primary and secondary circuits in the interest of safety. Results of water-hammer tests conducted by the Pacific Gas & Electric Company and the Southern California Edison Company were presented at the meeting of the hydraulic power committee and showed close agreement with the theory evolved in the report of last year's committee. A Pacific Coast meeting of the national hydraulic power committee was strongly urged. How to bring the practical features of accident prevention to the attention of construction and operating men was discussed at length in committee, information from a survey showing that accident-prevention organizations are reaching 97 per cent of the 30,000 electrical employees on the Pacific Coast.

Study of periodic testing of meters by the meter committee is expected to supply a proper test that will satisfy all requirements and result in some economies. Discussion in the underground systems committee indicated that a feeder and main system with independent transformer and secondary groups not operated as a network is favored in distribution practice by California hydro-electric companies.

A report presented in the prime movers committee contained curves and other data showing results from stage bleeding and feedwater heating with turbines of from one to four bleed points. A report on boiler and turbine room instruments brought out the opinion that an accurate and reliable oil meter is not yet available. The same report recommended that plant efficiency be recorded in B.t.u. per kilowatt-hour.

Sessions of the apparatus committee were devoted to discussion on oil circuit breakers, relays, station design and practice, operating methods and experiences, transformers and regulators and fire prevention. In the inductive co-ordination committee much of the time was taken up with a discussion of the Minneapolis tests of grounded power circuits and exchange telephone circuits.

The third engineering conclave of the year of the Engineering Section is to be held at Fresno, Cal., April 6-8.

Purchases and Mergers

Colorado Central Power Company Set Up—Long List of Transactions in All Parts of Nation

A NEW public utility company serving sixteen communities in Colorado has been created as a result of the sale (previously announced as rumored) of the Arapahoe Electric Light & Power Company of Englewood and Littleton, the Fort Lupton Power & Light Company and the Jefferson County Power & Light Company of Golden to the Electric Public Service Company of Chicago. The new company is known as the Colorado Central Power Company. R. A. Pratt is president. The territory embraces Englewood, Fort Logan, Fort Lupton, Golden, Hudson, Indian Hills, Johnstown, Keenesburg, Petersburg, Littleton, Milliken, Morrison, Platteville, Starbuck and Troutdale.

The Southwestern Light & Power Company of Oklahoma City has announced the purchase of the light and power plants at Clinton and Elk City from the Oklahoma Gas & Electric Company, and also the sale of the light and power plant of the Southwestern Light & Power Company at Shattuck to the Oklahoma Gas & Electric Company. The two electric light and power plants at Elk City, one owned by the Oklahoma Gas & Electric and the other by the Southwestern Light & Power, will be consolidated and operated under the management of the latter. The Corporation Commission has recommended this consolidation and has asked the Legislature to confirm it.

The Union Electric Light & Power Company of Illinois, a North American Company property, has purchased the Venice power plant of the Illinois Traction Company, a North American Light & Power Company property, for $4,125,000. The North American Company and the Middle West Utilities Company each own a substantial interest in North American Light & Power.

Stone & Webster have taken over the properties of the Nebraska Electric Power Company, which has had headquarters at Loup City, and will operate them from Scottsbluff, which is the Nebraska headquarters of the Western Public Service Company. The deal is said to involve in excess of a million dollars and gives the new owners possession of properties at Loup City, Lexington, Broken Bow, Gordon and Rushville and contracts for service with about 25 municipalities of west central and northwestern Nebraska.

Other transactions recently reported follow:

The Alabama Power Company on Jan. 19 took over the municipal light and power plant at Gordo, Ala., 30 miles from Tuscaloosa, a large majority of the citizens having voted for the plant to be sold.

Citizens of Moran, Kan., have begun a legal battle to prevent the Mayor and City Council from selling the municipal power plant to J. E. Houdashelt.

The Otter Tail Power Company, Fergus Falls, Minn., has bought the plants at Egeland, Bisbee, Rock Lake and Bottineau, N. D. The sale to it of the Rugby (N. D.) Light & Power Company will become effective June 1, the price agreed on being $75,000.

The Northern Power & Light Company, Mobridge, S. D., has bought the plant of the Napoleon (N. D.) Light & Power Company.

The Illinois Power & Light Corporation has been authorized to purchase all outstanding capital stock of the Champaign County Electric Company.

Merger of the Newport News & Hampton Railway, Gas & Electric Company and the Virginia Public Service Company, under the name of Virginia Public Service Company, of Charlottesville, has been approved by the Virginia State Corporation Commission.

A tentative offer of $2,000,000 for the municipal electric light and power, railway and water properties of Monroe, La., has been made by the Louisiana Power & Light Company, of which H. C. Couch is president.

Louisiana Ice & Utilities, Inc., has acquired municipal electric plants at Mansura and Lecompte, La.

The East Texas Public Service Company has purchased the electric light and power plant of the Henderson Light & Ice Company for a consideration of $180,000.

The Yuma (Ariz.) Utilities Company has been purchased by the Nevada-California Electric Corporation, a holding company which owns the stock of the Southern Sierras Power Company, the Nevada-California Power Company and other properties. The Yuma company has in the past bought its energy from the Southern Sierras company.

The town of Blair, Jackson County, Okla., voted Jan. 11 to sell its municipal electric lighting plant to the Southwestern Light & Power Company of Oklahoma City. Martha, also in Jackson County, voted a franchise to the same company.

Transfer of the Chickasha Gas & Electric Company, which serves 22 towns in Grady, Caddo, Canadian and McClain Counties, Okla., to the Southwestern Light & Power Company has been announced. The Chickasha company was formerly a subsidiary of the Public Service Company of Oklahoma. All these are Insull properties.

The Electric Power Company of Bouquet, Essex County, N. Y. has made application to the Public Service Commission for authority to transfer its franchise, works and systems to the Plattsburg Gas & Electric Company.

Merger of the Mexico (N. Y.) Electric Company and the Seneca River Power Company of Baldwinsville, N. Y., was approved on Jan. 8 by the Public Service Commission.

Announcement is made at Malone, N. Y., of the sale of the Eastern Canada Power Company, a new Carlisle property, to the Shawinigan Water & Power Company of Quebec. Franchises had been obtained, it is said, to serve all the towns lying between Malone and Valleyfield, the power to be supplied by the Malone Light & Power Company.

Herbert B. Rust has received authority from the Public Service Commission of New Hampshire to transfer electric utilities in Rumney, Warren and Wentworth to the Baker River Light & Power Company.

The Public Service Commission of New Hampshire has given the Southern New Hampshire Hydro-Electric Company permission to acquire additional electric properties in Colebrook, Columbia and Shelburne, now owned by the William F. Allen Company. It is also stated that the Southern New Hampshire company will take over other Allen utilities in Vermont and Quebec. The Southern New Hampshire Hydro-Electric Company is a subsidiary of the New England Public Service Company of Maine, an Insull property.

F. W. Swett Heads New England Credit Men

The New England Division of the National Electric Credit Association and the New England Electric Credit Club elected the following officers at the annual meeting of the organization in Boston on Jan. 18: President, Frank W. Swett, Atlantic Radio Company, Boston; vice-president, Alan R. MacDonald, Pettingell-Andrews Company, Boston; secretary and treasurer, C. A. Kane, Boston; directors, Messrs. Swett, MacDonald, C. N. Nickerson, and F. D. LeGro, Jr., Boston; national representative, C. R. Oliver, Wetmore-Savage Company, Boston.

Addresses at the annual banquet of the New England Division were made by Arthur Black, referee in bankruptcy, Boston, and F. P. Vose, national secretary, Chicago.

In the Legislative Mill

Measures Affecting Light and Power Companies Are Pending in Widely Scattered States

EFFORTS of farm interests of California to secure taxation of publicly owned and operated utilities have been renewed in the State Legislature of California, now in session at Sacramento. A constitutional amendment having the backing of farm interests has been introduced in the Lower House in the hope that it may be submitted to the voters at the next election. Under the terms of the bill all publicly owned utilities would be taxed in like manner and in like amount with private corporations. Previous efforts to gain public approval of a similar measure have failed at the polls.

A measure similar to the Jacobs bill of 1925 will be introduced in the present session of the Legislature at Olympia, Wash., by Senator Ralph Metcalf of Pierce County, in an effort to give cities with municipal hydro-electric plants the right to sell surplus power to outside communities. B. F. Jacobs, father of the Jacobs bill, which was defeated in the Senate after being passed in the House, is backing the Metcalf bill. The Washington Legislature has also before it a bill of wide scope which authorizes cities of the first class to refund utility revenue bonds. This bill may afford a way for the Seattle municipal light department to refund its bond retirement obligations when they reach their first peak in 1929. The department now has a bonded indebtedness of approximately $19,000,000 which must be paid out of the revenues of the department and retired not later than July 1, 1944. Under the state laws as they now stand, the City Council has no power to refund such bonds.

A bill has been introduced in the Wisconsin Legislature providing for the taxation of light and power companies operating electric railways according to the local rate of the community in which they operate, to replace the general tax rate method now in force. A bitter fight between advocates and opponents of the measure is expected. If the bill is enacted, the general tax rate of 2.01 now levied against these particular companies will be virtually doubled.

Legislation giving the Iowa State Railroad Commission power to regulate and control the transmission lines of the state is to be sought at the present session of the Legislature. The bill will require all utility companies asking franchises for such lines to file evidence of convenience and necessity.

Light and power companies are sponsoring a bill at Lincoln, Neb., to give them the right of eminent domain to facilitate acquisition of right-of-way. The Nebraska League of Municipalities is opposing indeterminate-franchise legislation and favoring municipal control of rates. A legislator has introduced a measure to prohibit any public utility company from selling merchandise not manufactured by it. Six months would be allowed to get rid of stocks on hand. Another bill provides that the mayor and council of cities

shall have power to fix rates for light, heat and power. Another prohibits city councils from permitting electric light companies, among other utilities, from charging more than the maximum rate fixed in the original franchise.

Public service companies of Kansas may find themselves faced with still another form of taxation if the State Legislature, now in session, acts favorably upon a proposal, recommended by Norton A. Turner, state budget director, that a "nominal" tax be imposed on every issue of public utility stocks or bonds. Kansas public utilities already pay thirteen kinds of taxes, it is declared.

Senator Charles B. Carter of Androscoggin County, Maine, has introduced bills into the Legislature to divorce the generation and the transmission of electricity and make it possible for the state to control transmission within the state and to other states.

Guy E. Tripp Wants a More Economical Lamp

Asserting that the incandescent electric lamp is "a most wasteful and extravagant form of conversion of electricity in to light," General Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, speaking before a dinner of Fitkin company executives at New York City on Jan. 21, called for further research into the possibility of minimizing its waste of energy, which he put at 95 per cent.

"The most modern and efficient steam turbine," General Tripp said, "turns out about 16 per cent of the theoretical power contained in heat units of coal. Here is 84 per cent of a field in which science may work, and who can say that some time, even in the near future, electricity may not be produced direct from heat, doing away with the steam-engine for that purpose? Even tomorrow there may be discovered a cheap, foolproof and durable storage battery which would revolutionize the electric light and power industry by enabling it to store electricity as gas is now stored in a gas holder or oil in a barrel."

Empire State Men Hear Talk on East River Station

Welcomed by Vice-president J. W. Lieb of the New York Edison Company when they assembled in that organization's West Twenty-seventh Street substation on Jan. 21, 72 delegates to the annual meeting of the Electric Section of the Empire State Gas and Electric Association carried out successfully the program of committee reports and speeches outlined in the ELECTRICAL WORLD for Jan. 15 (page 167). One departure from the program was, however, made by the substitution of an illustrated address on the new East River generating station of the New York Edison Company for the contemplated talk on operating experience with the 220-kv. Wallenpaupack system in Pennsylvania. R. H. Tapscott explained the details of the electrical design of the New York station and E. B. Ricketts described the steam equipment. Another feature of the meeting was an address on Saturday by A. E. Waller, managing director of the National Electrical Manufacturers' Association. C. H. Churchill, Jr., reported on farm electrification, with special reference to the reliability of appliances now deriving their motor power from rural lines.

W. C. Fisher, Mount Vernon, chief electrical engineer of the Westchester Lighting Company, was chosen to be chairman and A. R. Tremaine, general manager of the Depew & Lancaster Light, Power & Conduit Company, was elected vice-chairman of the section for the ensuing term.

Supply Manufacturers Meet

Radio Section to Become a Division of N.E.M.A.—Murphy Thinks Prices Are Now Low Enough

MIDWINTER meetings of the Supply Division of the National Electrical Manufacturers' Association were held last week at the Hotel Roosevelt, New York City. The section and subject committees were in session from Monday to Friday. The general meeting and banquet took place on Wednesday. The radio section carried through the plan proposed last year to organize the radio manufacturers as a separate division and announced that, under the auspices of the association, an extensive program to provide daylight broadcasting of a high-grade type for the purpose of enabling radio dealers to demonstrate receiving sets effectively in regular business hours would be carried out.

Vice-president D. H. Murphy, in addressing the Supply Division, said: "The public never demands a price so low as to rob the producer of a fair return, but on the contrary wants quality, demands safety and cheerfully pays for both. Furthermore, the public knows that quality and safety can be had only when the producer is allowed to operate at a fair profit. For many years there has been a distinct trend toward lower prices and lower quality, and may it not be possible that some lines of electrical supplies have gone as far as it is safe to go in that direction and that the time for a reaction has come? Certainly, there is no crying need for still lower prices."

Joseph A. Fowler, president of the Association of Electragists International, talked on the intangible values of trade association work and discussed present conditions in the electrical contracting industry frankly. Earl Whitehorne reported as chairman of the Industry Conference on Wiring, outlining its present status. The National Electric Light Association, he said, is about to hand in the brief presenting its case in the controversy between the N.E.M.A. wiring committee and the Association of Electragists, and when this is received the conference will proceed with its work. H. B. Kirkland discussed the work of the uniform code and ordinance field service.

Others on the program were Harry Collins Spillman, who spoke at the banquet; H. R. Sargent, S. L. Whitestone, S. L. Nicholson and A. E. Waller, managing director of the association.

Briefer News

Philadelphia Electric Grants Wage Dividend. — The Philadelphia Electric Company has just granted a wage dividend of $500,000 to its army of employees in that city and its environs. This is the fifth annual wage dividend authorized by the company's directorate for "service performed and contribution to the economies of operation."

N.E.L.A. Committee Meetings Next Week.—Meetings of the meter, prime movers, underground systems, accident prevention, overhead systems, electrical apparatus, hydraulic power and inductive co-ordination committees of the N.E.L.A. will be held at headquarters in New York City next week, from Wednesday to Saturday inclusive. In addition, the executive committee of the Engineering National Section will meet on Thursday, Feb. 3, at 4:30 p.m.

Kansas Now Has a Real Utility Office Building.—To Abilene, Kan., goes the honor of erecting the first large building in the state devoted exclusively to housing a public utility organization. The United Power & Light Corporation and its associated companies will soon move into their new general headquarters building, occupying one of the principal business corners of the city. The company serves 143 Kansas cities and towns with electric light and power.

Date of Denver Franchise Election Definitely Set.—It has been definitely determined that the 20-year franchise of the Public Service Company of Colorado shall be voted on by the taxpayers at a special election on Feb. 8. The expense of the election is to be borne by the company, which is acquainting its subscribers with the provisions of the proposed franchise, estimated to effect an annual saving of $672,500, by means of a rider on its monthly service bills showing the actual saving to individuals.

Weleetka, Okla., to Have 45,000-Kw. Generating Plant.—Construction has started on the first 15,000-kw. generating unit for the Public Service Company of Oklahoma, according to President F. W. Insull. This plant, which will eventually comprise three units of that rating, is being built at Weleetka and will be connected by a 66,000-volt transmission line with the Oklahoma Power Company's West Tulsa plant. It will serve Okmulgee, Henryetta, Okemah, Crowder, Canadian and Dustin.

Michigan to Have an Engineering Conference.—The second Michigan Engineering Conference will be held on Feb. 3 and 4 at the Hotel Statler, Detroit. The program includes a dinner meeting during which "Engineering Research" will be discussed by C. F. Kettering of Detroit, W. R. Whitney of the General Electric Company and others; a discussion on "Engineering Education," participated in by William

E. Wickenden and Dr. Alexander C. Humphreys, and speeches on the relation of engineering to health, safety, traffic and transportation.

Connecticut Electric Service Opens Hartford Office.—The Connecticut Electric Service Company, which controls the Connecticut Light & Power Company of Waterbury, the Eastern Connecticut Power Company of Norwich and the Bristol & Plainville Electric Company, has established a central office at Hartford in the United States Security Trust Building and moved the accounting departments of the three companies there. Meetings of the directors will be held at Hartford at future instead of in New York City.

Middle West N.E.L.A. Has Publication Devoted to Load Building.—The *Load Builder*, a weekly four-page bulletin, is now being published by the Middle West Geographic Division of the N.E.L.A. It aims to be a digest of general information, research and reference, to build up the load of power and light companies. Information is assembled in four departments—lighting, merchandising, cooking and power. Bozell & Jacobs, Inc., Omaha, Neb., specialists in public utility advertising and publicity, are in charge of the division's load-building program and publish the new periodical.

Another High-Pressure Turbine for Boston Edison.—Another steam turbine operating under a steam pressure of 1,200 lb. is to be installed soon by the Boston Edison Company in its Edgar plant. The original unit, a 3,000-kw., 3,600-r.p.m., 20-stage turbo-generator, was installed in 1925. The additional machine will be of 10,000 kw. capacity at 3,600 r.p.m. There is, besides, a 7,000-kw. unit operated at 1,200 lb. pressure in use by the Milwaukee Electric Railway & Light Company. The three high-pressure units are all of General Electric manufacture.

East Texas Public Service in 1926.—New properties were added to the system of the East Texas Public Service Company last year in Pittsburg, Leesburg, Newsome, Winona, Hawkins, Beckville, Carthage, Center, Teneha and Cass. The company now serves 42 cities and towns in Texas. It completed 158 miles of transmission in 1926, 51 miles rated at 66,000 volts and nearly all the rest at 33,000 volts. The system is tied in with that of the Texas Power & Light Company at Edgewood, and at Bloomburg it connects with the Southwestern Gas & Electric Company's 132,000-volt line between Shreveport, La., and Texarkana, Tex.-Ark.

Municipal Utility Men of Ontario Back Hydro Commission Policies.—Addressing at Toronto last week the annual meeting of the Association of Municipal Electrical Utilities of Ontario, which embraces municipalities using power from the Ontario Hydro-Electric Power Commission, C. A. Maguire, the association's representative on the commission, said that the people of Ontario would have reason to be well satisfied with the proposed agreement between the commission and power interests developing Carillon Falls on the Ottawa River. Mr. Maguire also asserted that the commission was opposed to the proposed renewal of the charter granted 20 years ago for the Georgian Bay Ship Canal, which he claimed was being sought for the power rights contained in it. The association passed resolutions affirming its stand against rights being given to private corporations to develop power in Ontario and asking the Dominion government to accept the Hydro-Electric Power Commission's plans for the St. Lawrence development.

Keokuk-Kewanee High-Tension Line Nearly Ready.—Equipment has been shipped for the Kewanee (Ill.) substation of the Illinois Power & Light Corporation, and it is hoped to complete the high-power line from the Keokuk (Iowa) hydro-electric plant into Kewanee by Feb. 1. The Kewanee substation will be 300 ft. x 250 ft. in size, with a power supply of 14,000 kw. Surveys are under way for the Joliet line, which will be the next to be finished, and Rock Island and Peoria connections will follow. With the completion of these Kewanee will have four sources of power.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 1, page 80.]

National Association of Lighting Equipment Dealers—Hollenden Hotel, Cleveland, Jan. 31-Feb. 5. G. P. Rogers, 424 Guarantee Title Bldg., Cleveland.

Northwest Electric Light and Power Association, Commercial Section—Multnomah Hotel, Portland, Ore., Feb. 10 and 11. G. C. Sawyer, Pacific Power & Light Co., Portland.

American Institute of Electrical Engineers—Midwinter convention, New York, Feb. 7-10; Southwestern District, Kansas City, March 17-18; Middle Eastern District, Bethlehem, Pa., April 14-16. F. L. Hutchinson, 36 West 39th St., New York.

New Mexico Utilities Association—Franciscan Hotel, Albuquerque, Feb. 14-16. B. L. Wiles, Albuquerque Gas & Electric Co., Albuquerque.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Feb. 18 and 19. E. F. Kelley, Louisville Railway Co., Louisville.

Iowa Section, N.E.L.A.—Dubuque, Feb. 24 and 25. H. E. Weeks, Davenport, Iowa.

Oklahoma Utilities Association—Huckins Hotel, Oklahoma City, March 8-10. E. F. McKay, 307 Local Building, Oklahoma City.

Northwest Electric Light and Power Association, Engineering Section—Portland, Ore., March 10 and 11. O. L. LeFever, Northwestern Electric Co., Portland.

National Electrical Manufacturers' Association, Policies Division.—Briarcliff Manor, N. Y., March 17-18. S. N. Clarkson, 30 East 42d St., New York.

Southeastern Division, N.E.L.A.—Peabody Hotel, Memphis, Tenn., April 13-15. C. M. Kilian, 404 Wynn-Claughton Bldg., Atlanta.

Southwestern Division, N. E. L. A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Nebraska Section, N. E. L. A.—Grand Island, Neb., April 27-28. H. M. Davis, 1519 O St., Lincoln.

Enlargement of Charleston (S. C.) Plant.—The capacity of the steam-electric plant of the Charleston (S. C.) Consolidated Railway & Lighting Company (now part of the South Carolina Power Company) is to be doubled, according to an announcement by Stuart M. Cooper, president of the company. Work on a 10,000-kw. addition will be begun in 30 days, with completion scheduled for Oct. 1. The enlarged plant will serve as a reserve station after high-tension lines are constructed connecting Charleston with the transmission system of the Southeastern Power & Light Company.

Colorado Has New 125-Mile Transmission Line. — According to reports from Craig, Col., the final link in the 125-mile high-tension line between Oak Creek and Craig has been completed and the district of northwestern Colorado between Phippsburg and Craig is now being served from a central generating plant at Oak Creek. The franchises of this section are owned by the Colorado Public Utilities Corporation, which is now building a modern generating station at McGregor, to be put into operation some time in February and to utilize waste fuel from a local coal mine.

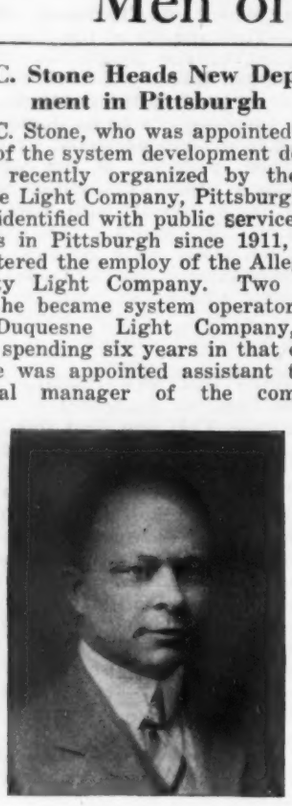
For Rural Service in Texas.—Representatives of light and power companies, agricultural and technical schools, farmers and business men interested in rural electric service met in Dallas, Tex., recently to further that object. The meeting was held under the auspices of the rural lines committee of the Southwestern Public Service Association. It was called to order by J. W. Carpenter, vice-president and general manager of the Texas Power & Light Company and chairman of its rural lines committee. T. O. Walton, president of the Texas Agricultural and Mechanical College, was elected permanent chairman of a new committee which was set up to study and serve the power needs of the farmers.

Governor Pinchot Divides the Sheep from the Goats.—As reported in the ELECTRICAL WORLD for Jan. 15 (page 161), Governor Pinchot of Pennsylvania before retiring from office approved 26 charters for subsidiary lighting companies desiring to serve rural communities in that state and disapproved 48, his decision in every case being based on the proposed rates. The parent companies of the 26 subsidiaries seeking charters and proposing to charge an average rate of 9 cents or less and the number of applications made by them were: Pennsylvania Power & Light, 2; Metropolitan Edison, 10; Penn Central Light & Power, 14. The parent companies where applications were rejected because rates were more than 9 cents or were not specified comprised: Carlisle Gas & Water, 1; Scranton Electric, 1; Pennsylvania-Ohio Power & Light, 7; Potomac Edison, 5; Keystone Power, 5; Penn Public Service, 7; Susquehanna County Light & Power, 18; North Penn Power, 4.

Men of the Industry

E. C. Stone Heads New Department in Pittsburgh

E. C. Stone, who was appointed manager of the system development department recently organized by the Duquesne Light Company, Pittsburgh, has been identified with public service companies in Pittsburgh since 1911, when he entered the employ of the Allegheny County Light Company. Two years later he became system operator with the Duquesne Light Company, and after spending six years in that capacity he was appointed assistant to the general manager of the company.



E. C. STONE

Since 1922 he has been planning engineer of the Duquesne company.

Mr. Stone is a native of Charlestown, N. H., and a graduate of Harvard University. For five years following graduation he served as engineer of transformer design with the Westinghouse Electric & Manufacturing Company, East Pittsburgh. The new department which Mr. Stone has been selected to head will exercise general supervision over all design and construction, including scope of projects and progress of work. It will do planning work and prepare budgets, will assemble, analyze and report on company statistics and make economic and cost studies.

Robert Strite has been appointed power engineer with the Malden Electric Company, Malden, Mass.

H. C. Johnson, general manager, secretary and treasurer of the Southern Nebraska Power Company, Superior, has resigned.

Lewis E. Gettle, chairman of the Wisconsin Railroad Commission since 1922, when he succeeded Carl D. Jackson, will be reappointed by Governor Zimmerman. His new term will expire in 1933.

Ely C. Hutchinson, since 1922 vice-president and general manager of the Pelton Water Wheel Company, San Francisco, has been appointed president and general manager of that organization. In 1908 he became associated with the Pelton Water Wheel Company, and since that time he has made an intimate study of hydraulic problems peculiar to the Pacific Coast and is responsible for several important features of design now embodied in hydraulic turbines. He has been prominent in several national societies and is one of the advisers on prime movers for the United States national committee of the International Electrotechnical Commission.

Gadsden Renominated to Board of U. S. Chamber of Commerce

Philip H. Gadsden, a vice-president of the United Gas Improvement Company, Philadelphia, has again been nominated for election as a director of the United States Chamber of Commerce. Mr. Gadsden is a candidate to represent the second election district on the board. For some years Mr. Gadsden has been prominently identified with the national chamber, having been elected as a director in 1920. In addition, he became a director of the Philadelphia Chamber of Commerce in that same year, subsequently being elected vice-president and, early last year, president. He has also served as a director of the Pennsylvania State Chamber of Commerce.

During the war Mr. Gadsden served as chairman of the National Committee on Public Utility Conditions, representing the interests of the electric, railway and gas companies in connection with their war problems. A native of South Carolina and a lawyer by profession, he retired from the active practice of law to manage and direct local public utilities. It was in 1918 that he was elected to a vice-presidency in the United Gas Improvement Company in charge of its department of public relations.

Judge L. D. Hill of Sparta, Tenn., has been sworn in as a member of the Railroad and Public Utilities Commission of Tennessee, to which he was elected last November.

C. E. Bennett, manager of the electrical department of the Georgia Railway & Power Company, has been given general charge and supervision of all electrical operation, maintenance, engineering and construction within the seven-mile zone. He will also have general charge and supervision of all operation and maintenance of the electric transmission and distribution system of the Georgia Railway & Power Company outside the seven-mile zone, and in addition, the electric transmission and distribution systems of the Athens Railway & Electric Company, the Georgia Southern Power Company, the Rome Railway & Light Company, the Georgia Utilities Company and the Mutual Light & Water Company. **W. P. Hammond,** assistant chief engineer of the Georgia Railway & Power Company, has been given general charge and supervision of all electrical engineering and construction outside the seven-mile zone for that company and the others just named. **C. A. Collier,** general sales manager of the Georgia Railway & Power Company, has been placed in charge of all their sales activities.

Dixon Succeeds Blaisdell at Pittsfield Works of G. E.

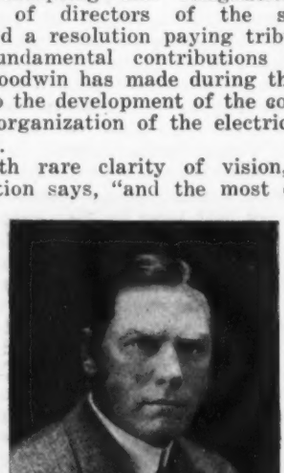
Carl Sumner Dixon has been been appointed general superintendent of the Pittsfield (Mass.) works of the General Electric Company, succeeding Arthur F. Blaisdell, who resigned last month to remove to San Diego, Cal. Mr. Dixon was born in Newfields, N. H., in 1883 and after extended experience in the manufacturing field came to the Pittsfield works sixteen years ago as foreman of the casting section of the foundry. He was made a divisional superintendent in 1915. Mr. Blaisdell is a native of Freeport, Ill. He entered the Pittsfield works in 1911 as superintendent, following varied activities in manufacturing.

C. A. Leland, Jr., assistant general manager and chief engineer of the Kansas Power & Light Company, Topeka, has been made general manager of the United Power & Light Corporation, Abilene. The latter organization, one of the largest of its kind in the state, is under the control of the former company, operated by the Studebaker interests. Mr. Leland will retain his residence in Topeka, where two years ago he directed construction of the Tecumseh power plant. Before his connection at Topeka he was in charge of the Illinois Power & Light Company's holdings in Atchison, Kan.

W. L. Goodwin Resigns Office in S. E. D.

William L. Goodwin, who has been operating vice-president of the Society for Electrical Development for the past eight years, has resigned. In regretfully accepting this resignation the board of directors of the society adopted a resolution paying tribute to the fundamental contributions which Mr. Goodwin has made during this period to the development of the co-operative organization of the electrical industry.

"With rare clarity of vision," the resolution says, "and the most coura-



W. L. GOODWIN

geous idealism, supported by untiring industry and energy that is indefatigable, he has pioneered in the thinking of the industry toward a closer and more purposeful co-ordination among electrical men for market development."

Mr. Goodwin's resignation takes effect April 1, with leave of absence from Jan. 1. No successor has thus far been

named. Mr. Goodwin is now engaged in the formation of a company which will serve as counselor in market development and industrial co-operation. Offices have been established at 522 Fifth Avenue, New York City. The new company will start operations April 1, 1927.

F. D. Brown, general manager of the People's West Coast Hydro-Electric Corporation, Portland, Ore., successor to the West Coast Power Company and now owned by the W. B. Foshay Company, is a comparatively new arrival in the utility field in the Northwest. He removed to Portland from the Middle West, where he had been engaged in public utility work for some years, at the time the West Coast properties were acquired by their present owners in the fall of 1926. For eight years he had charge of the Huron (S. D.) Light & Power Company, a combined gas and electric property, as secretary and manager. Later he joined the organization of the Wisconsin-Minnesota Light & Power Company as district manager of its eastern district at Owen, Wis., leaving finally to ally himself with the W. B. Foshay interests. Before assuming the duties of his present position he had charge of the northern district of the Minnesota Electric Distributing Company.

Harry L. Judd, who has been affiliated with the Public Service Company of Northern Illinois for eighteen years as district manager in Oak Park, has been promoted to the position of assistant to Vice-president Charles W. Bradley.

Isaac B. Smith, formerly vice-president of the Iowa Railway & Light Company, Cedar Rapids, Iowa, has been elected president of the company to succeed Colonel William C. Dows, who died last fall.

C. H. Kreger, formerly assistant engineer of the Public Service Company of Northern Illinois, has been appointed engineer on station electrical design. In this capacity Mr. Kreger will have supervision over all engineering work in connection with the electrical design of stations, substations, distribution centers and other similar electrical installations. The following men were appointed designing engineers, reporting to Mr. Kreger: A. S. Butler, L. E. Brown, O. B. Dorsey, C. Hodgson, R. J. Parmenter and R. B. Wendell.

Beran, Cranston and Monroe Vice-Presidents of G. E. Company

Theodore Beran, H. L. Monroe and J. A. Cranston, who have been elected commercial vice-presidents of the General Electric Company, as announced in the Jan. 8 issue of the ELECTRICAL WORLD, have all been affiliated with that organization for a number of years. Mr. Beran has been manager of the New York district area of the company since 1903. He was born in 1862 at Springfield, Mass., was educated in the public schools of New York City and later received an A.B. degree from the College of the City of New York. He is an associate member of the American Institute of Electrical Engineers, past-president of the New York Electrical Society and vice-president of the Electrical Board of Trade of New York.

THEODORE BERAN

J. A. CRANSTON

H. L. MONROE

A native of Parkersburg, W. Va., Mr. Monroe entered the employ of the Thomson-Houston Company in Chicago in 1888. Two years later he was transferred to the railway department in Chicago and in June, 1894, was made a salesman operating out of the Dallas (Tex.) office of the company. He was appointed manager of the railway department of the Chicago district in 1905 and in 1913 was named district sales manager. Since September, 1913, he has been district manager in Chicago. He is a director of the Electric Association of Chicago and president of the Illinois Contract Purchase Corporation, as well as being a member of clubs in Chicago, New York, Detroit, Schenectady, St. Louis and Quebec.

Mr. Cranston affiliated himself with the Northwest Thomson-Houston Company in 1888 in St. Paul, subsequently being transferred to Portland, Ore., to represent the company as sales agent. At the time the General Electric Company was organized in 1892 he associated himself with that company and was made manager of the Portland office in 1900. He served in that capacity until 1919, when he became Northwest manager. It was in 1923 that Mr. Cranston became Pacific Coast manager to succeed Dr. Thomas Addison, who retired.

C. A. Fees, for the last seven years president and general manager of the Kansas Power Company, Concordia, with properties in several sections of the state, has now become identified with the headquarters office of the A. E. Fitkin interests, New York City, of which the Kansas Power Company is a subsidiary. Mr. Fees for a time at least will continue to maintain his home in Concordia. Mr. Fees until recently was president of the Kansas Section, N.E.L.A., and has been active in public utility association work in the Middle West. Mr. Fees' successor as president and general manager of the Fitkin interests in Kansas is E. A. Wright, of the Michigan Public Service Company, Cheboygan. Mr. Wright is not new to Kansas, having managed properties at Manhattan and Great Bend a number of years ago.

Obituary

David C. Davis, special patent attorney for the Westinghouse Electric & Manufacturing Company, died Jan. 22 in his forty-first year.

Samuel O. Edmonds, patent attorney and counsel for the General Electric Company for more than twenty years, died Jan. 20 at his home in New York in his fifty-seventh year. Mr. Edmonds was a native of Pottsville, Pa., and had engaged in the practice of patent law since 1886. He was a member of the American Institute of Electrical Engineers.

Charles J. Root, treasurer and assistant treasurer for more than 25 years of the Empire Gas & Electric Company, Geneva, N. Y., died at his home in that city Jan. 17, following a brief illness. Mr. Root was well known in political life, having served as a supervisor of Ontario County, N. Y., for ten years. He was a native of Clyde, N. Y., but received his education in Geneva. For a time he resided in Elmira and in New York City, returning to Geneva in 1903 to become treasurer of the Empire Coke Company.

Peter S. Klees, Eastern manager for the Erie Malleable Iron Works at 50 Church Street, New York City, died Thursday, Jan. 20, following an operation for appendicitis, at the age of 48. Mr. Klees was widely known in manufacturing and jobbing circles, having been identified for a number of years with prominent companies in a sales capacity. A native of Lebanon, Pa., he entered upon his career in the electrical industry as an employee of the American Electric Lamp Company of Philadelphia, with which he remained until he formed a connection with the Franklin Electric Manufacturing Company, Hartford, Conn. For twelve years he served that organization in the capacity of sales manager, in 1918 being advanced to the office of vice-president. Mr. Klees became district manager for the Tubular Woven Fabric Company in its New York territory and was promptly promoted to the office of general sales manager, from which position he resigned early last year. Mr. Klees was active in national association work, having devoted special attention to the National Electric Light Association, the Illuminating Engineering Society and the Associated Manufacturers of Electrical Supplies.

Recent Court Decisions

Ductility of Tungsten Not Patentable.—Invention involves not only mental conception but manual application, and the discovery of the cold ductility of tungsten is not patentable, the United States District Court for Delaware held last week in a patent infringement suit between the General Electric Company and the De Forest Radio Company. Letters Patent No. 1,082,933 were issued to the General Electric Company, as assignee of Dr. William D. Coolidge, in 1913, for improvements in tungsten and methods of making tungsten for use in filaments of incandescent electric lamps and other purposes. The patentee brought a suit in equity charging the De Forest Radio Company with contributory infringement of certain process claims and against that company and the Robelin Piano Company for infringement of certain product claims of the patent. The acts charged were the manufacture and sale of radio tubes having ductile tungsten filaments made by an alleged infringing manufacture of drawn tungsten wire and the resale of the tubes by the Robelin Piano Company. The defendants contended that the claims made were invalid. The product claims were attacked for want of patentable subject matter, in that they call for a product of nature, that the raw material to which the process is applied and the product resulting from that process are, alike, the element tungsten, and that the properties of the product, like those of the original body, are discovered natural, not invented artificial properties. The plaintiff did not deny that a wire or rod of a prior patent was a coherent mass of tungsten and as such the starting body called for by its patent, but averred that until Dr. Coolidge did his work and accomplished his results it was not known that the prior rod constituted a suitable starting body. The claims in the suit call for tungsten that is pliable or ductile at room temperature, and one problem involved in the trial was to determine whether ductility is a natural or an artificial property of tungsten, whether tungsten ductile cold is a "manufacture" or a product of nature, and whether a single element of nature not patentable before mechanical treatment may be made patentable by subjecting it to mechanical treatment. (Abstract from *United States Daily.*)

Transmission Lines Must Be Built to Withstand Normal Storms.—The Nebraska Supreme Court, in holding the Western Public Service Company liable in damages to Alva O. Williams, who was injured when he drove his team along a road where the wind following a sleet storm had broken a wire, his horse being killed, has ruled that it is not error to instruct the jury that a transmission-line company is bound legally so to construct its lines that they will withstand normal wind and sleet storms. The company had protested that this was an unreasonable requirement. The court said that transmission-line companies will be held to use such care in the construction, control and operation of their lines as is proportionate to the danger attaching to their presence along highways used by the general public. It is for the jury to determine what degree of care was exercised in the case before it for consideration, the company being bound only to use reasonable care. It will be expected that the jurors will be men familiar with the character of the wind and sleet storms and thus be competent to judge if the particular one under investigation was normal or otherwise. The company's defense was that it had built the line according to the standards of construction and that it was safeguarded against any ordinary hazard of its existence.

Void Incumbrance on Property of Electric Company Cannot Be Validated by Public Service Commission.—It was urged by the defense in Cooper County Bank vs. Bank of Bunceton, Mo., that the plaintiff as the owner of a deed of trust in controversy affecting the Bunceton Ice, Light & Fuel Company should have procured its validation by the Public Service Commission. The Kansas City Court of Appeals refused to entertain this contention, saying: "We find no law, nor are we cited to any, whereby the Public Service Commission is given power to validate a deed of trust which is void under the statute." (288 S. W. 95.)*

Water-Power Company Need Not Recoup County for Cost of Bridge When No Overflow Has Resulted from Dam.—The Nebraska Supreme Court has relieved the Blue River Power Company of any liability to the County of Seward arising out of the company's construction of a dam across the Blue River. The county board, anticipating that the construction work would result in flooding the adjacent highway, expended a considerable sum in building a bridge and sued to recover the cost. A lower court gave it judgment, but the Supreme Court now holds that as the dam has never yet caused an overflow, a judgment cannot be permitted for damages never inflicted.

Circumstances Under Which Commission Decisions May Be Disturbed.—The Bluefield Telephone Company appealed against a decision of the Public Service Commission of West Virginia to the Supreme Court of Appeals of that state, which dismissed the petition, asserting that an order of the commission would not be annulled by it unless the order manifested unlawful, abritrary or capricious exercise of power. The fact that the commission determined rates from the history of the utility, instead of from the opinions of an expert witness who testified for the utility, was not a reason for disturbing the decision. Judicial review should extend no further than is necessary to keep the commission within the law and protect the constitutional rights of the corporations which it controls. (135 S. E. 833.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Unfair Comparisons of Rates.—The rates for utility service cannot be shown to be unreasonably high by comparison with rates of similar utilities in similar communities where the utilities in such communities are earning an inadequate return or where the actual earnings are not conveniently available. This was a finding of the Indiana Public Service Commission in adjudicating a complaint made by the city of Loogootee against the Loogootee Water Company.

Deposits to Cover Cost of Meters Have No Bearing on Rate Base.—The Utah Public Utilities Commission has decided that the value of meters belonging to the Big Spring Electric Company should be included in the rate base, although consumers have to deposit the cost of their meters to obtain service. The reason for the inclusion was that these deposits are the property of the consumer and a liability of the company, and, therefore, in the commission's opinion, the deposits have no bearing on the rate base.

Service from Village Plant No Encroachment on Territory of Company Whose Franchise Is Subject to Prior Rights.—A complaint of the Bergen Rural Electric Company against the village of Bergen, N. Y., alleging the unlawful furnishing of current from the village plant to residents of a nearby rural section has been dismissed by the New York Public Service Commission. It was brought out that the village plant had been authorized by the commission ten years previously and that the lines were extended to the section in question at a time when there was no other service for that area. As the franchise subsequently granted to the Bergen Rural Electric Company was limited and subject to the rights of the village, the company was held to have no ground for complaint.

Contract Rates for Continuous Period Disapproved. — The Michigan Public Utilities Commission has refused in a case affecting the Dickinson County Public Service Company to approve rate contracts that are to be operative for a continuous period of time. The rates were for electric street lighting and wholesale municipal power. The commission said that it did not look with favor upon a contract rate covering a stated period of time, for the reason that such an agreement does not permit the commission or an interested party to adjust such rates in case conditions or circumstances change. The commission went on to say, however, that if the company desired to submit the schedules for approval, dependent solely upon a contract as to the length of time for which the customer must agree to take service, and not restrict the application of the rates to any length of time, it would consider the application.

Financial and Corporate

Stocks Withstand Break

Utility Bond Market Makes New High Records in Prices and in Volume of Sales

PUBLIC utility stocks have again displayed their ability to withstand a general break in other branches of the security markets. In the face of selling pressure which drove industrial and rail prices down for losses exceeding six or seven points in certain active issues, power and light stocks remained virtually unchanged. In fact, some marginal gains were made. The strength of these issues in contrast with the sharp break elsewhere is reminiscent of the situation last March, when industrials crashed nearly twenty points on the average against an average loss of less than ten points by the utility stocks. The average of fifteen representative electric power and light stocks computed by the ELECTRICAL WORLD stands at 94 for the week ended Jan. 26, the same figure as that of the previous week.

Among the counter stocks of power and light companies National Public Service participating preferred and Arizona Power preferred both gained several points. There was strong demand on the curb market for several utility issues, such as American Light & Traction. Among the common issues the outstanding gain was that of Public Service of New Jersey, which rose four points over a week ago, to 102.

The buoyancy which has characterized the bond market for public utility issues since the first of the year has advanced to the point where many price and sales records of long standing have been wiped out. New issues coming forward in larger volume than ever before have not in any degree affected the strength of the older issues. Gains were made by such bonds as Empire Gas & Fuel Company 6½'s and Kings County Light 5's. Investment bankers experienced in these issues anticipate continued strength, giving as evidence the present large volume of investment money and the current condition of the money market. They point also to the possibility of tax reduction.

Western Massachusetts Holding Company Organized

For the purpose of acquiring all the outstanding common stock of the Turners Falls Power & Electric Company a voluntary association called the Western Massachusetts Companies has been formed. The object of the new association is to make more permanent the relations between the company and the distributing companies in the Connecticut Valley which are affiliated with this organization. Among these are the Greenfield Electric Light & Power Company, Amherst & Easthampton Gas Companies and the Agawam Electric Company. Under the plan holders of the Turners Falls company's common stock will receive in exchange four shares of no-par-value common stock of the Western Massachusetts Companies, and enough of the common shares of the affiliated companies to insure control will be purchased. Dividends on the new shares will be at the rate of $2 per year, corresponding to the present eight-dollar annual rate on the Turners Falls stock. Stockholders have until April 1 to deposit their stock. No present change in the management or policies of the companies concerned is contemplated. Twelve of the fourteen trustees of the Western Massachusetts Companies are now directors of the Turners Falls company. Headquarters of the system is at Greenfield, Mass.

Colorado Utility to Increase Capital. —Stockholders of the Southern Colorado Power Company will vote Feb. 15 on increasing the number of shares of 7 per cent cumulative preferred stock from 40,000 to 100,000.

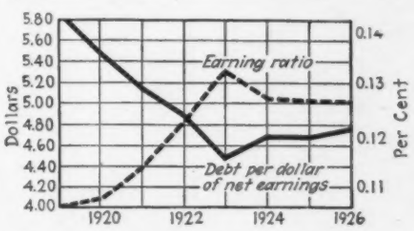
Consolidated Gas Plans Record Issue

Stockholders of the Consolidated Gas Company of New York will be asked at their annual meeting Feb. 24 to ratify a proposal of the directors of the company for a piece of financing involving more than $163,000,000 in common and preferred stocks. After allowance for the retirement of outstanding present preferred stock, the financing will result in providing the company with more than $146,000,000 in new money and will give stockholders subscription rights, trading in which began last Tuesday and will cease March 17, when the rights expire. According to the plan, holders of the present common stock will be permitted to subscribe to the new common at $75 a share. The new preferred will be sold to holders of common stock at $91 a share. Stockholders will be permitted to subscribe to one share of the new common for every five shares now held and to the new preferred at the rate of one share for every three held. Listing of new common will follow approval.

Some Debts Out of Proportion to Earnings

Certain Power and Light Companies Outside Recognized Limit of Ten Dollars Debt per Dollar Net

SOME of the leading power and light companies are carrying a larger proportion of obligations in relation to earnings than is considered proper and equitable by authorities in the investment banking field. The relationship between funded debt and net earnings and also that between funded debt plus preferred stock and net earnings are important checks upon the financial standing of utility companies. These methods of gaging the position of utilities are particularly important in the case of companies contemplating the flotation of new securities. Their position for one or two years may mean nothing, but an unduly high volume of debt in relation to earnings over a period of years is regarded as an indication of unsatisfactory conditions.



DEBT PER DOLLAR OF NET EARNINGS OF ELECTRIC LIGHT AND POWER INDUSTRY

A study of the statistical position of the industry as a whole in relation to funded debt per dollar of net earnings was recently completed by the ELECTRICAL WORLD. The indebtedness is taken to be 60 per cent of the total capitalization of the industry. The analysis shows that during the past eight years the industry carried an average of $4.90 of debt per dollar of net, the figure being higher in 1920 than at any time since. After that a gradual decline took place to a low point of $4.50 in 1923. Owing to expansion in the industry and the installation of new and modern equipment, which in many cases exceeds immediate requirements, the proportion of indebtedness to net earnings has steadily risen since 1923 and now stands at approximately $4.90, or the average for the eight-year period. Increased bond financing since 1923, due to an expanding market for bonds and decreasing money rates, is also a factor in the rise in this ratio. It provides a valuable check which each company may use for purposes of comparison with that relating to their own company.

Another study covered ten representative power and light operating companies. In the case of these companies an average of $6.40 of indebtedness for every dollar of net earnings was shown for the year 1925. The range of the companies studied is from $4.20 to $9.90. In actual practice a growing concern is expected to show not more than $10 of debt for each dollar of net earnings, and any figure below this is considered to reflect a

reasonably satisfactory situation. The majority of the companies were well below the ten-dollar limit. Certain companies, such as the Illinois Power & Light Corporation and Oklahoma Gas & Electric Company, were only marginally below the limit, owing presumably to specific reasons. The lowest ratio of any company studied was that of the Duquesne Light Company, which showed $4.15 of indebtedness per dollar of net. Obviously the ratio is meaningless in the case of utilities which have adopted the plan of financing their undertakings without borrowing.

PREFERRED STOCK FURTHER CHECK

A further check upon the position of the company may be secured by application of the ratio (preferred stock + debt) ÷ net earnings. Study of a representative group of companies using this ratio showed an average of $9.60 of preferred stock plus debt in relation to net earnings. In actual practice financial houses usually hold that it is feasible for this ratio to be as high as $12, but any figure above that is questioned, especially in the case of companies about to sell new issues. Among the companies studied, two had a higher ratio than $12 per dollar of net, and this would suggest a more careful analysis of the position of these companies, with a view to ascertaining the cause of the high ratio. As in the case of any other ratio, the situation must be studied individually, as a low or a high ratio may be due to certain individual factors. When such factors are carefully taken into account, the ratio provides a valuable and convenient measure of a company's position at any time.

DEBT PER DOLLAR OF NET, ENTIRE INDUSTRY

Jan. 1	Funded Debt	Net Earnings	Ratio
1920	$2,460,000,000	$442,750,000	$5.50
1921	2,640,000,000	512,000,000	5.15
1922	2,880,000,000	590,550,000	4.90
1923	3,120,000,000	692,670,000	4.50
1924	3,480,000,000	736,590,000	4.70
1925	3,960,000,000	845,400,000	4.70
1926	4,500,000,000	949,000,000	4.75
1927	5,040,000,000	1,033,000,000	4.90
Eight-year average			$4.90

Stock Increase Approved.—Stockholders of the Philadelphia Electric Company have approved an issue of 2,000,000 new shares of common stock.

New Capital Issues

First lien and refunding mortgage gold bonds of the South Carolina Power Company were issued during the week under review to the amount of $4,000,000. These bonds, dated Jan. 1, 1927, and maturing Jan. 1, 1957, were priced at 95 and interest, yielding 5.33 per cent. They will be secured by a direct mortgage on the entire fixed public utility property and public utility rights and franchises of the company, subject only to the lien of the Charleston Consolidated Railway, Gas & Electric Company consolidated (closed) mortgage.

The Tide Water Power Company issued first lien and refunding mortgage gold bonds to the amount of $2,000,000, the price being 98¾ and interest, to yield about 5.54 per cent.

The Cities Service Company issued 250,000 shares of common stock, which issue was oversubscribed.

The Indianapolis Power & Light Company again participated in the week's new financing to the extent of $12,000,000 in the form of 6½ per cent cumulative preferred stock. The stock was priced at $98 per share and accrued dividend, to yield over 6.63 per cent. The sale of this preferred stock

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 25	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	k 85	70½*	98*
Adirondack Pwr. & Lt.—7% pf.	105½	101*	108½*
Adirondack Pwr. & Lt.—8% pf.	118	101*	115*
Ala. Pwr., 7% pf.	108½	....	....
Allis-Chalmers Mfg., 7% pf.	110½	110	111
Allis-Chalmers Mfg., 6% com.	89	88½	92½
Aluminum Co. of Amer., com.	71½	70½	72
Aluminum Co. of Amer., 6% of.	101	98½*	103½*
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	88½	88	89½
Amer. & Foreign Pwr., com.—no par	19½	19½	23
Amer. Bosch Magneto, com.—no par	13½	13	17½
Amer. Brown Boveri Elec†	37	37½	39
Amer. Brown Boveri Elec., pf. $7	k 97½	86½*	97½*
Amer. Gas & Elec., 6% pf.—no par	96½	91*	98½*
Amer. Gas & Elec., com.†—no par	69	69	100½
Amer. Lt. & Trac., 6% pf.	111	108*	133*
Amer. Lt. & Trac., com.†	233	224½	233
Amer. Pwr. & Lt., 6% pf.	....	....	....
Amer. Pwr. & Lt., com.†—no par	57	56½	61½
Amer. Pub. Serv., 7% pf.	k 96	92*	97½*
Amer. Pub. Serv. com.†	50	45*	80*
Amer. Pub. Utilities, 6% pr. pf.	86	73*	89*
Amer. Pub. Utilities, 7% ptc. pf.	71	86*	95*
Amer. Pub. Utilities, com	m66	68*	82*
Amer. States Sec., A	3½	2*	9½*
Amer. States Sec., B	4½	1½*	5½*
Amer. Superpwr., $6 D f.—25	27½	26½	27½
Amer. Superpwr., 7% pf.	l 94	....	....
Amer. Superpwr., Class A†—no par	28½	28½	29
Amer. Superpwr., Class B†—no par	29	28½	29½
Amer. Wtr. Wks. & Elec., 7% pf.	109	105½	110½
Amer. W. W. & E., com. $1.20—20	66½	62½	67½
Anaconda Copper Cap. $3	47½	47½	49½
Appalachian Electric Pwr., 7% pf.	k 99	90*	101*
Appalachian Elec. Pwr., 2d pf., 7%	98	99*	102*
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	76	60*	82*
Arizona Pwr., com.	23	22	24½
Arkansas Cent. Pwr., pf.—$7 no par	k101	99*	107*
Arkansas Lt. & Pwr., 7% pf.	102	96*	104*
Arkansas Lt. & Pwr., com.	100	110*	115*
Assoc. Gas & Elec., $3.50—50	50½	....	....
Assoc. Gas & Elec., pf.—$6—no par	86½	79½*	86½*
Assoc. G.&E., Class A, $2.50—no par	37	35	37
BABCOCK & WILCOX, 7% com.	116	117*	151*
Binghamton L., H. & P., $6 pf.	92	90*	95*
Birmingham Elec., pf.—$7—no par	105½	101*	108*¶
Blackstone Valley G. & E., $6 pf.	102	103*	106*
Blackstone Valley Gas & Elec., 10% com.—50	k105	100½*	106*
Blaw-Knox, com.†	i 70½	45*	80*
Brazilian Trac., Lt. & Pwr., com.†	f112	....	....
Broad River Pwr., 7% pf.	95	93*	98*
Brooklyn Edison, 8% com.	150½	150	154½
Buffalo, Niagara & East. Pwr., pf.—25	i 25½	....	....
Buffalo, Niagara & East. Pwr., com.†—no par	i 27½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	94	89*	95*
California Ry. & Pwr., 7% pf.	110	88*	130*
Carolina Pwr. & Lt., pf.—$7—no par	f107½	107	108
Central & S.W. Util., 7% pf.—no par	a 95½	89½*	96½*
Central & S.W. Util., pr. lien $7 pf.—no par	a100½	93*	100*
Central Ariz. Lt. & Pwr., 8% pf.	109	103*	108*
Central Ark. Ry. & Lt., 7% pf.	101	99*	101*
Central Ill. Pub. Serv., 6% pf.	k 86	89*	91*
Central Ind. Pwr., 7% pf.	86½	84½*	93½*
Central Pwr. Lt., 7% pf.	99½	94*	103½*
Central States Elec., 7% pf.	90	91*	97*
Central States Elec., com.†	m200	200*	230*
Century Elec., 6% com.	m117	110*	117*
Chicago Fuse Mfg., com.—$2.50 no par	m 30½	30*	35*
Cincinnati Gas & Elec., 5% com.	g 95½	93½	95½
Cities Service, 6% pf.	l 91½	91½	92½
Cities Service, pf. B—10	l 8½	8½	8½
Cities Service, pf. BB—100	l 82	82	82½
Cities Service, com.—20	l 53½	50½	53½
Cities Service, Bks. Shrs.—10	l 26	25	26
Clarion River Pwr., 8% pf.	95	93*	95*
Cleveland Elec. Ills., 6% pf.	108	103*	109*
Cleveland Elec. Ills., 10% com.	300	240*	310*
Colorado Pwr., 7% pf.	k 95	96*	97*
Columbia Gas & Elec., 6% pf.	100½	100	101½
Columbia G. & E. com. $2.60—no par	87	87	91
Columbia Ry., Gas & Elec., 6% pf.	94	65*	96*
Columbus Elec. & Pwr., 2d. pf.	103	....	....
Columbus Elec. & Pwr., 9% com.	55	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	98	98*	99½*
Columbus Ry., Pwr. & Lt., 6½% pf. B	96½	92*	97*
Columbus Ry., P. & L., com.—no par	70	70*	85*
Commonwealth Edison, 8% com.	a140½	135½*	145*
Commonwealth Pwr., 6% pf.	90½	82	93½
Commonw'th Pwr., $2, com.—no par	44	42½	45
Conn. Lt. & Pwr., 8% pf.	118	117*	121*
Conn. Lt. & Pwr., 7% pf.	118	108*	113*
Cons. Gas of N. Y., pf.†—50	56½	57*	62½*
Cons. Gas of N. Y., com $5—no par	102½	102½	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e107½	102*	107*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	k110	107*	112*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e111	109*	115*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e126½	124*	128½*
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 52	45*	57½*
Consolidated Pwr. & Lt., 7% pf.	106	100*	107*
Consumers Pwr., 6% pf.	99	95*	101½*
Consumers Pwr., 6.6% pf.	104	101½*	106*
Continental Gas & Elec., 7% ptc. pf.	104	96*	109½*
Continental Gas & Elec., 7% pr. pf.	100½	95½*	101½*
Conti. G. & E. com. $4.40—no par.	k295	85*	210*
Crocker Wheeler, com.†	27	14*	26*¶
Crocker Wheeler, 7% pf.	75	50*	70*
DALLAS PWR. & LT., 7% pf.	106	102*	110*
Dayton Pwr. & Lt., 6% pf.	101	95*	100*
Detroit Edison, 8% com.	135	133½	136½
Dubilier Condenser, com.—no par	3½	3½	4
Dubuque Elec., 6% pf.	k 93	93*	98½*
Duquesne Lt., 7% pf.	k115	....	....
EASTERN NEW YORK UTIL., $7 pf.	102	80*	104*
Eastern New York Util. com.	k 65	70*	75*
Eastern States Pwr., $7, com.	11	12*	32½*
Eastern States Pwr., pf.	92	89*	95*
East. Tex. Elec., 7% pf.	105	100*	107*
East. Tex. Elec., com. $5—no par	75	70*	80*
Edison Elec. of Boston, 12% com.	d221	207*¶	230*
El Paso Elec., com. $5—no par	70	70*	94*
El Paso Elec., 7% pf.	102	102*	106½*
Elec. Bond & Share, 6% pf.	f107½	107½	109
Elec. Bd. & Sh. Sec., com. $1—no par	f 68	70	72½
Electric Household Util.†	a 12	11½*	25*
Elec. Investors, 6% pf.—no par.	91½	87*	95*
Elec. Investors, com.†—no par.	35½	34½	37
Elec. Investors, 10% pd. receipts.	20	12*	56*
Elec. Pwr. & Lt., ctfs. pf.	96½	96	96½
Elec. Pwr. & Lt., ctfs., 40% pd.	104½	104½	104½
Elec. Pwr. & Lt., ctfs. full pd.	k103½	102½*	110½*
Elec. Pwr. & Lt., ctfs., com.—no par.	17	17½	18½
Elec. Refrig. cap.†	35½	32½	37½
Elec. Ry. Securities, com.—no par.	m 8	....	....
Elec. St. Battery com. $5.25—no par	76½	75½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	100	97½*	101½*
Emerson Elec., pf.	m105	101*	105*
Empire Pwr., A $6	25½	26½	27½
Engr. Pub. Serv., $7 pf.—no par.	97½	93½	98
Engr. Pub. Serv., com. $7—no par.	22½	21½	24
Eureka Vacuum Cleaner, com. $4—no par	61½	61½	67½
FAIRBANKS MORSE, 7% pf.	k108	106½*	115*
F.-M., com.—$2.60—no par	42½	39½	42½
Federal Lt. & Trac., com.†	40	37½	42½
Federal Lt. & Trac., pf. $6	k 91	86*	94*
Ft. Worth Pwr. & Lt., 7% pf.	f108	109	109
GALVESTON-HOUSTON ELEC. 6% pf.	67	65*	70*
Galveston-Houston Elec., com.	25	....	....
Gen. Elec., 8% com.	83½	82½	85½
Gen. Elec., special—10	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A, $1.50—no par	k 42½	41½	45
Gen. G.&E. (Del.) com. B—no par.	m 42	36*	48½*
Gen. G.&E. (Del.) pf. A. $8—no par.	k115½	105½*	113*
Gen. G.&E. (Del.) pf. A $7—no par.	k105	95*	100*
Gen G.& E. (Del.) pf. B $7	k 97½	92½*	96*
Gen. Pub. Serv., $7 pf.	k103	102*	106*
Gen. Pub. Serv., com.	k 13	11*	16½*
Ga. Lt., Pwr. & Rys., 6% pf.	89	82*	98*
Ga. Lt., Pwr., & Rys., com.	m 60	65*	80*
Ga. Ry. & Pwr., 8% pf.	k118	112*	122*
Ga. Ry. & Pwr., 7% pf.	105	100½*	108½*
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr., 4% com.	120	....	....
Gt. Western Pwr., 7% pf.	k102	....	....
IDAHO PWR., 7% pf.	104	103*	106*
Ill. No. Utilities, 6% pf.	k 88	88*	92*
Ill. Pwr. & Lt., 7% pf.	98½	96½	100½
Ingersoll Rand com. $8	k 93	80½*	104*
Int. Combus. Engr., com. $2—no par	46½	45½	49½
Int. Util., Class A—$3.50—no par.	k 29½	24*	39*
Int. Utilities, Class B—no par.	4½	3	5½
Interstate Pwr., pf.—$7—no par.	92	90*	98*
Interstate Pub. Serv., 7% pf.	98	96½*	99½*
Iowa Ry. & Lt., 7% pf.	96	98*	100*
JERSEY CENTRAL PWR. & LT., 7% pf.	97	94*	98½*
Jersey Cent. Pwr. & Lt., 7% ptc. pf.	110	95½*	112*
Jersey Cen. Pwr. & Lt., com.—no par	k 25	25*	50*
Johns-Manville, com.†—no par.	62½	55½	66

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Franisco; iPittsburgh; jWashington. kBid price Saturday, Jan. 22. lBid price Wednesday, Jan. 26. mLatest quotations available. *1926. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 25	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k112½	107½*	115*
Kansas Gas & Elec., 7% pf.	l103	103	103½
Kentucky Hydro-Elec., 7% pf.	a 94½	91½*	95½*
Kentucky Sec.,6% pf.	82	75*	85*
Kentucky Sec., 5% com.	k108	90*	108*
Kentucky Utilities, 6% pf.	k95	90*	96½*
Keystone Pwr. & Lt., 7% pf.	k97	95*	98½*
LACLEDE GAS LT., 8% com.	k170½	146*	196½*
Lehigh Pwr. Sec., com.—no par.	17½	15½	18
Long Island Ltg., 7% pf.	108	105*	112*
Long Island Ltg., com. $2—no par.	145	120*	150*
Los Angeles Gas & Elec., 6% pf.	98½	95½*	100*
Louisville Gas & Elec., cl. A. $1.75	24½	23½	25
MAN. ELEC. SUPPLY, cap. $4.25—no par	53½	53½	57½
Manila Elec., com.†—no par.	41	40	41
Maytag Mfg., com. .50—no par.	27½	23½	27½
Memphis P. & L., pf.—$7—no par	107½	103*	110*
Metropolitan Ed., pf.—$6—no par.	95	91½*	98*
Metropolitan Ed., pf.—$7—no par.	103½	102*	108*
Metropolitan Ed., com. $5—no par.	k 60	45*	60*
Middle West Utilities, 7% pf.	a107½	97½	111½*
Middle West Util., 7% pr. lien pf.	a118½	106½*	123½*
Middle West Util., com. $6—no par	a111	108*	135*
Midland Utilities, pr. ln. 7% pf.	a 98½	97*	111½*
Midland Utilities, 7% pf. A.	a 97	96*	99½*
Milwaukee Elec. Ry. & Lt., 7% pf.	k101	100*	103*
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	87*	100*
Minn. Pwr. & Lt., 7% pf.	l104	100	106
Miss. Pwr. & Lt., $8 pf.	106	102*	107½*
Miss. River Pwr., 6% pf.	k 94½	93*	96*
Miss. River Pwr., com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	101½	102½	105
Mohawk Hudson Pwr., 2d pf.—$7—no par	98	90*	102*
Mohawk Hudson Pwr., com.—no par	22½	20½	23
Montana Pwr., 7% pf.	118½	118½	118½
Montana Pwr., 4% com.	k 82½	81½	83½
Montreal Pwr., 7½% com.	f 72	....	....
Mountain States Pwr., 7% pf.	96	97*	102*
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	98	93*	101*
National Carbon, 8% pf.	m130	124*	130*
National Elec. Pwr., A†	24½	23½	25
National Elec. Pwr., 7% pf.	a 95	92*	96½*
National Lt., Ht. & Pwr., com.	24	22*	25*
National, Light, Ht. & Pwr., 5% pf.	70	71*	73*
National Pwr. & Lt., pf.—$7—no par	102½	101½	103
National Pwr. & Lt., com.†—no par.	20½	20½	22
National Pub. Serv., 7% pf.	94	91	94
National Pub. Serv., 7% ptc., pf.	110	96*	112*
National Pub. Serv., A com. $1.60—no par	21½	18½	21½
National Pub. Serv., B com.—no par	16½	14	16½
Nebraska Pwr., 7% pf.	l107½	107½	108½
Nevada-Calif. Elec., com.	m 26½	18½*	44½*
New Brunswick Pwr., 7% pf.	58	30*	60*
New Eng. Pub. Serv., pr. ln. pf. $7..	98	98*	101
New Eng. Pub. Serv., pf. $7.	93	95½*	97*
New Orleans Pub. Serv.—7% pf.	102	100*	105*
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	89*	95*
N. Y. Central Elec., 7% pf.	102	98*	103*
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	98*	112*
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	98*	114*
Niagara Falls Pwr., 7% pf.—25.	28½	28½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	l13½	113½	l13½
No. Amer., 6% pf.—50.	51	50	51½
No. Amer., com.—10.	47	45½	49½
No. Amer. Edison, $6 pf.—no par.	100½	96½	100½
No. Amer. Lt. & Pwr., 7% pf.	101	85*	104*
No. Caro. Pub. Serv., pf.—$7—no par	94	89*	96*
Northeastern Pwr., com.	17½	16½	18½
No. Indiana Gas & Elec., 7% pf. A.	101½	99*	103½*
No. N. Y. Utilities, 7% pf.	104	103*	105½*
No. Ohio Pwr., com.—no par.	11½	9½	12½
No. Ohio Trac. & Lt., 6% pf.	76	78*	81*
No. Ohio Trac. & Lt., 7% pf.	90	88*	96*)
No. Ont. Lt. & Pwr., 6% pf.	k 87	75*	88½*
No. Ont. Lt. & Pwr., 4% com.	74	73*	78*
No. States Pwr., 7% pf.	102	99½*	103½*
No. States Pwr., 8% com.	110½	109½	111½
No. Texas Elec., 6% pf.	58	48*	65*
No. Texas Elec., 4% com.	25	15*	45*
OHIO BRASS, com. B $4—no par.	76	70*	80*
Ohio Brass, 6% pf.	100	98*	101*
Ohio Gas & Elec., 7% pf.	94	90*	95*
Ohio Pwr., 6% pf.	97	90*	97*
Ohio Pub. Serv., 6% pf.	d94½	94½	94½
Ohio Pub. Serv., 7% pf.	d104½	103½	104½
Ohio River Edison, 7% pf.	102½	98½*	105*
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	k100½	99*	102½*
Pacific Gas & Elec., 8% new com.	32½	32½	33
Pacific Pwr. & Lt., 7% pf.	l102½	102½	102½
Parr Shoals Pwr., 6% pf.	98	90*	97½*
Penn Cent. Lt. & Pwr., $5 pf.—no par.	c 72½	70½*	91*
Penn-Ohio Edison, 7% pf.	98	....	....
Penn-Ohio Elec., 7% pf.	95	93*	96*
Penn-Ohio Pwr. & Lt., 7% pf.	98	94*	100*
Penn-Ohio Pwr. & Lt., 8% pf.	109	100*	111*
Penn Pwr. & Lt.—$7—no par.	l107½	105½	106½
Penn Pub. Serv., 6% pf.	87	85*	90*
Penn Wtr. & Pwr., 8% com.	e178	140*	180*
Phila. Co., 6% pf.—50.	50½	50	50½
Phila. Co., com.—50.	k 88	59½*	91½
Phila. Elec., 8% com.—25.	c 52½	41½*	67½*
Pittsburgh Utilities, 7% pf.—10.	m19½	14½*	20½*
Portland Elec. Pwr., 7% pf.	98	97*	101*
Portland Elec. Pwr., 6% pf.	84	71*	87*
Portland Elec. Pwr., 6% 2d pf.	70	71*	75*
Portland Elec. Pwr., com.	29	26*	48*
Potomac Elec. Pwr., pf.	j108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m79	77½*	90½*
Pwr. Sec., pf.—no par.	k 37	10*	39*
Pwr. Sec., com.—no par.	k 5	4*	13*
Public Serv. of Colorado, 7% pf.	l 99	99	99
Pub. Serv. of N. J., 7% pf.	k109	103½*	110*
Pub. Serv. of N. J., 8% pf.	k125½	115*	124½*
P. S. of N. J., $5 com.—no par.	34	32	35
Pub. Serv. of No. Ill., 6% pf.	a104	99½*	106*
Public Serv. of No. Ill., 7% pf.	a113½	112*	116½*
P. S. of No. Ill., com. $8—no par.	a132	121	140
Pub. Serv. of No. Ill., 8% com.	a132	128	143
Pub. Serv. of Okla., 7% pf.	98½	97*	100*
Pub. Serv. Elec. & Gas, 6% pf.	103	102	103
Pub. Serv. Elec. Pwr., 7% pf.	k114½	106*	114*
Puget Sound Pwr. & Lt., 7% pf.	102	103*	108*
Puget Sound Pwr. & Lt., 6% pf.	83	82*	84½*
Puget Sound Pwr. & Lt., com.	31	....	....
RADIO CORP. OF AMER., pf.—50.	51½	50½	52
Radio Corp. of Amer., com.—no par.	53½	47½	54½
Republic Ry. & Lt., pf.	115	95*	120*
Republic Ry. & Lt., com.	124	75*	116*
Rochester Gas & Elec., 5% pf.	m95	....	....
Rochester Gas & Elec. Ser. D, 6% pf.	102	98*	102*
Rochester Gas & Elec., 7% pf.	102	105*	107*
SAFETY CABLE, com. $4.	55½	52½	56½
San Joaquin Lt. & Pwr., 7% pf.	106	97½*	108*
St. Joseph Ry., L., H. & P., 5% pf.	70	60*	70*
Servel Corp.	9	7½	9½
Sierra Pacific Elec., com.	24	26½	37½
Sioux City Gas & Elec., 7% pf.	101½	96*	101½*
Southeastern Pwr. & Lt., pf.—$7—no par.	l101½	97*	103*
Southeastern Pwr. & Lt., $6 ptc. pf.,	l 67½	60*	68½*
Southeastern Pwr. & Lt., com.—no par.	31½	30½	32½
So. Calif. Edison, 8% pf.	36	32½*	36*
So. Calif. Edison, 7% pf.	28½	27½	28½
So. Calif. Edison, 6% pf.	24	....	....
So. Calif. Edison, 8% com.	33½	31½	34½
Southern Cities Utilities, 7% pf.	85	85	90*
Southern Cities Utilities, com. $4.	23	....	....
Southwestern Lt. & Pwr., A $3.	63	52*	60*
Southwestern Lt. & Pwr., B.	63	38*	58*
Southwestern Lt. & Pwr., $6 pf.	83	78*	82*
Southwestern Pwr. & Lt., 7% pf.	105½	104	105½
Springfield (Mo.) Ry. & Lt., 7% pf.	97	95*	100*
Standard Gas & Elec., 8% pf.	58½	57½	58½
Standard Gas & Elec., 7% pf.	106	104½	106
Standard G. & E., com. $3—no par.	54½	54½	55½
Standard Pwr. & Lt., 7% pf.	96	90*	98½*
Staten Island Edison, pf.—$6—no par.	96	93*	97½*
Superheater, $6 com.—no par.	167	138*	173*
Syracuse Lighting, 7% pf.	102	105*	107*
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.	300	260*]	355*
TAMPA ELEC., com. $2.	47	49	57½
Tenn. Elec. Pwr., 6% pf.	92	87*	90*
Tenn. Elec. Pwr., 7% pf.	102	98*	105*
Terre Haute, Ind. & East. Trac., 5% pf.	20	20*	37*
Terre Haute, Ind. & East. Trac., com	1	1*	7*
Tex. Pwr. & Lt., 7% pf. ex. div.	l106	107	109
Tide Water Pwr., 8% pf.	105	101*	106*
Timken Roller Bear., com.—$4 no par.	90½	78	90½
Toledo Edison, 8% pf.	l114	114	114
Toledo Edison, 7% pf.	l104½	104	104½
Toledo Edison, 6% pf.	l 94½	94½	94½
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	90	87½*	92*
UNITED GAS & ELEC., 6% pf.	98	94*	97*
United Gas & Elec., com.—no par.	m57	56*	66*
United Gas & Elec. (N. J.) 5% pf.	67	70*	75*
United Gas Impr., 8% com.—50.	c 91½	84½*	144½*
United Lt. & Pwr., pf.—$4—no par.	50	44*	53*
United Lt. & Pwr., pf.—$6.50—no par.	87	81*	91*
United L. & P., com. A .48—no par.	14½	13½	15½
United L. & P., com. B .48—no par.	k 16	13*	29*
Utah Pwr. & Lt., 7% pf.	l104½	103½	104½
Utica Gas & Elec., 7% pf.	105	103*	106*
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	93	92*	98*
Utilities Pwr. & Lt., com. A $2.	28½	27	29½
Utilities Pwr. & Lt., com. B $1—no par.	14½	13½	14½
VERMONT HYDRO-ELEC., 7% pf.	95	94*	96*
Virginia Elec. & Pwr., 7% pf.	104	101*	105*
Virginian Pwr., 7% pf.	108	102*	104*
Virginian Pwr., com.	70	65*	75*
WAGNER ELEC., 7% pf.	b 73	70	76
Wagner Elec., com.†—no par.	b 24	18½	24
Washington Ry. & Elec., 5% com.	j190	....	....
Washington Ry. & Elec., 5% pf.	j 90½	....	....
Washington Wtr. Pwr., 8% com.	136	130*	138*
West Mo. Pwr., 7% pf.	m92	....	....
West Penn Elec., 7% pf.	107	102	107
West Penn Elec., Cl. A $7.	101½	97½	102
West Penn Pwr., 7% pf.	k114	108	115
West Penn Pwr., 6% pf.	102½	100½	103
West Virginia Lt., Ht. & Pwr., 7% pf.	94½	95*	98*
West Va. Utilities, 7% pf.—50.	48½	43*	51*
Western Pwr., 7% pf.	97	....	....
Western States Gas & Elec., 7% pf.	95½	89*	94½*
Western States Gas & Elec., com.	17	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	68½	67½	70½
Weston Elec. Instrument, Cl. A $2.01—no par.	32½	30½	32½
Weston Elec. Instrument, com.—no par.	15½	15	15½
Wheeling Elec., 6% pf.	k 95	91*	97*
Wis., Pwr., Lt. & Ht., 7% pf.	k 95	85*	91*
Worthington Pump, 7% pf. A.	k 46	44*	80*
Worthington Pump, 6% B.	k 40	37½*	65*
Worthington Pump, com.	21½	21½	24
YALE & TOWNE com. $5—25.	k 72	60½	72½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Franisco; iPittsburgh; jWashington. kBid prices Saturday, Jan. 22. lBid price Wednesday, Jan. 26. mLatest quotations available. *1926. †Dividend rate variable.

will provide funds to be used in connection with the acquisition of the business and properties, free of existing funded debt, of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company.

The largest single offering was made by the Narragansett Company in the form of collateral trust gold bonds, series A, to the amount of $27,500,000, the price being 99 and accrued interest, yielding about 5.06 per cent. The Narragansett Company, a Rhode Island corporation, will own upon completion of this financing over 96 per cent of the outstanding capital stock of the Narragansett Electric Lighting Company.

With the purpose of acquiring the common stock of the Community Power & Light Company, the American Commonwealth Power Corporation, the organization of which was announced in the Jan. 22 issue of the ELECTRICAL WORLD, issued 6 per cent gold debentures, series A, to the amount of $3,500,000, the price being 95 and accrued interest, to yield about 6.40 per cent. Though scheduled for formal offering Jan. 26, the whole issue had been sold in advance.

Company Reports

The following statements of earnings have been issued by electric light and power companies:

Name of Company	Gross Earnings Twelve Months Ended Dec. 31 1926	1925
Adirondack Power & Light..	$9,327,201	$8,340,064
Associated Gas & Electric...	*28,802,770	*17,603,537
Bangor Hydro-Electric.....	1,732,114	1,589,500
Central Illinois Light.....	4,197,746	3,910,119
Cities Service.....	25,438,362	19,764,976
Commonwealth Power.....	49,197,543	44,174,864
Consumers Power.....	24,135,477	20,684,973
Illinois Power.....	2,581,131	2,491,800
Ohio Edison.....	1,815,937	1,564,958
So. Indiana Gas & Elec.....	2,883,251	2,671,996
Tennessee Electric Power...	11,909,560	11,479,637

* Twelve months ended Nov. 30.

Railway & Light Securities Company Declares Extra Dividend.—Directors of the Railway & Light Securities Company have declared an extra dividend of $2 per share in addition to the regular semi-annual dividend of $1 per share on the common stock, no par value, both payable Feb. 1 to holders of record Jan. 21.

Public Service Electric & Gas to Change Set-up. — Stockholders of the Public Service Electric & Gas Company will vote Jan. 31 on increasing the authorized 6 per cent cumulative preferred stock, 1925 series, from 300,000 shares to 1,000,000 shares, par $100, and on eliminating 400,000 shares of 6 per cent cumulative preferred stock now authorized. If the amendment is adopted, the capital stock of the company will consist of 20,000,000 shares of common stock (no par value), 200,000 shares of 7 per cent cumulative

preferred stock, 100,000 shares of 6½ per cent cumulative preferred stock and 1,000,000 shares of 6 per cent cumulative preferred stock, 1925 series. The increase is proposed as part of the plan already announced for consolidating with the Public Service Electric & Gas Company nine companies now operated by it under long-term leases.

Two Foreign Loans Floated

Two foreign loans were floated in the American market during the past week, raising a total of $12,000,000. The Lombard Electric Company (Società Lombarda per Distribuzione di Energia Elettrica) issued first mortgage 7 per cent external sinking-fund gold bonds, series A, to the amount of $6,000,000. The Lombard company is one of the oldest and best known of the Italian electric companies, having been incorporated in 1897. It supplies power in the highly developed industrial region of about 800 square miles in the northwestern part of Italy adjacent to Milan, the number of consumers being about 80,000 out of a total population of over 500,000. These bonds, priced at 94 and interest to yield over 7.50 per cent, will be secured by a first mortgage or first lien on all of the hydro-electric plants and other plants for the production and distribution of electric power of the Lombard Electric Company and its subsidiary the Alto Brembo Company. Proceeds of the issue will be used for the acquisition and construction of hydro-electric and thermo-electric plants, transmission and distribution systems and for improvements and additions to present properties, or for reimbursement of expenditures made for such purposes or for other productive purposes.

The International Power Securities Corporation, which early this month floated a ten-million-dollar loan, issued 7 per cent secured gold bonds, series F, to the amount of $6,000,000. These bonds, dated Jan. 15, 1927, and maturing Jan. 15, 1952, were priced at 95½ and interest, to yield about 7.40 per cent. The company was organized by prominent American interests primarily to acquire securities of electric light and power companies operating in this country or foreign countries. These bonds will be direct obligations of the International Power Securities Corporation and in addition they will be secured by a closed first mortgage made by the Società Generale Elettrica dell' Adamello (Adamello General Electric Company) and by one of its subsidiary companies, Società Idroelettrica dell' Ozola (Ozola Hydro-Electric Company.)

Buffalo General Electric Elects New Directors. — The following new members have been added to the board of directors of the Buffalo General Electric Company: Alfred H. Schoellkopf, vice-president and general manager of the Buffalo, Niagara & Eastern Power Corporation, and Horace L. Mann, treasurer of the Buffalo General Electric Company for a number of years, who recently was made vice-president. Other directors are Edward J. Barcalo, Richard F. Bolles, Walter P. Cooke, Fred D. Corey, Nisbet Grammer, Edward B. Holmes, William R. Huntley, Daniel J. Kenefick, Robert W. Pomeroy, DeLancey Rankine, Paul A. Schoellkopf, George Urban, Jr., and William C. Warren. J. Martin Hogan, who has been with the Buffalo General Electric organization for more than 25 years, was elected assistant secretary. Other officers continue in office as follows: William R. Huntley, president and general manager; George Urban, Jr., vice-president; Daniel J. Kenefick, vice-president; Horace L. Mann, vice-president and treasurer; Paulding F. Sellers, vice-president in charge of operation; Walter P. Cooke, secretary; Edward C. Cursons, assistant treasurer; William C. Bingham, assistant treasurer; Charles D. Warren, assistant secretary.

Tampa Electric Establishes New Dividend Policy.—A new dividend policy has been inaugurated by the Tampa Electric Company for paying regular dividends on the common stock (no par value) in cash and in common stock. A quarterly cash dividend of 50 cents a share, payable Feb. 15 to holders of record Jan. 31, and a quarterly dividend of one one-hundreth of a share of common were declared, subject to the consummation of an increase in the authorized common stock. The initial stock dividend will be paid, not later than fifteen days after the increase in the authorized common stock has become effective, to holders of record Feb. 9. In the preceding two quarters cash dividends of 62½ cents each were paid.

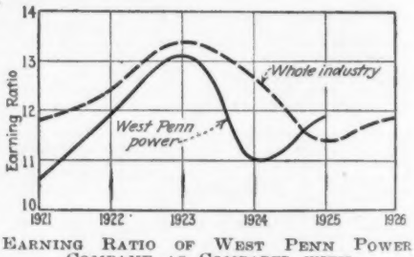
West Penn Power Net Up 8 per Cent

Operating Expenses Showed Substantial Decline at End of 1925 as Compared with Figures for Previous Year

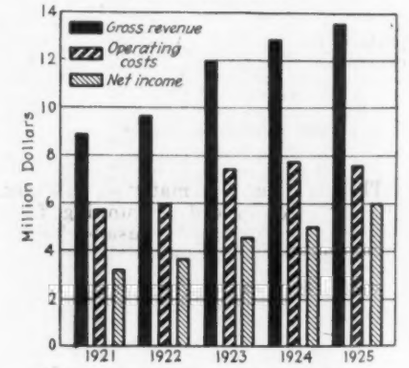
A SMALL increase in gross earnings combined with an actual decline in operating costs gave the West Penn Power Company a rise of more than 18 per cent in net earnings at the end of 1925. Actual costs of operation declined from $7,056,674 to $6,880,098.

The financial set-up of this company discloses little that can be adversely criticised. Indebtedness constitutes 55 per cent of capital, and annual revenue is approximately one-fifth of capital.

West Penn Power's earnings have shown a steady rise over a considerable period of years. Gross revenue has almost doubled in a six-year period, and net has increased by well over 50 per cent, comparing very favorably with the progress of the entire industry. The company carries $7.50 of debt per dollar of net earnings, which is above the average but well within limits. Bond interest was earned nearly three times in 1925, and the average for a six-year period was two and three-tenths times. Earnings per share on preferred for 1925 were $26.25, and the average for six years was $33.77 a share.



EARNING RATIO OF WEST PENN POWER COMPANY AS COMPARED WITH WHOLE INDUSTRY



GROSS AND NET INCOME OF WEST PENN POWER COMPANY SINCE 1921

SET-UP, EARNINGS AND FINANCIAL POSITION OF WEST PENN POWER COMPANY

1. **Financial Set-Up** (Dec. 31, 1925):
   - Ratio debt to capitalization, 55.5 per cent.
   - Ratio gross revenue to capitalization, 20.8 per cent.
   - Ratio gross to funded debt, 37.4 per cent.
   - Ratio investment to capitalization, 94.5 per cent.
   - Ratio gross to investment, 19.6 per cent.
2. **Revenue Record:**
   - Ratio operating expenses to gross, 55.9 per cent.
   - Ratio revenue to total assets, 17.2 per cent.
   - Ratio net earnings to revenue, 35.6 per cent.
   - Times bond interest earned, 2.3.
   - Preferred dividends earned, $26.25.
   - Preferred dividend paid on both issues.
   - Earnings compared with whole industry—Parallel.
   - Debt per dollar of net, $7.50.
3. **Trust Investment Tests:**
   - Life of franchise after bond maturity—Unlimited as to duration.
   - Percentage debt to book value of property, 52 per cent.
   - Size of gross, $14,780,920.
   - Size of net, $4,814,418.
   - Type of mortgage—Amount unlimited—In series.
4. **Business Progress:**
   - Per cent increase in gross, 5.6.
   - Per cent increase in net, 18.3
   - Per cent increase in customers, 11.4.
   - Per cent increase in energy generated, 16.6.

West Penn Power Company carries on a light, heat and power business, operating chiefly in the southwestern portion of Pennsylvania, exclusive of Pittsburgh and its environs.

Electric Bond & Share Stockholders Approve Increase in Capital.—Changes in the capital set-up of the Electric Bond & Share Company, outlined in the Jan. 8 issue of the ELECTRICAL WORLD, were ratified by the stockholders at a special meeting Jan. 21. The increase in capital stock to $100,000,000 from $50,000,000 will be divided into 500,000 shares of $100 par—250,000 shares of preferred and 250,000 shares of common.

Manufacturing and Markets

Buying Methods of Large Organizations

Inefficiency in Selling a Common Fault That Can Be Remedied by Thorough Knowledge of Procedure—Typical Case Outlined and Method of Sales Attack Described

By a Purchaser

PURCHASES made by a large organization usually originate in the engineering division. This engineering division is nearly always a highly organized department and probably has a number of executives whose functions are largely managerial. There are also a number (probably smaller) of executives who are engineering experts of wide experience in the construction field. The scope of these experts is generally very broad. In general, all purchase orders and engineering drawings pass under their supervision, and they especially endeavor to standardize engineering and to co-ordinate purchases originating in many subdivisions to a large extent independent and more or less out of touch with each other.

Very large individual orders running into the hundreds of thousands of dollars are handled directly by these engineering experts, and the salesman deals directly with them. These experts also supervise rather closely large orders for material which are not important enough to be placed on contract, but are nevertheless at the time strategically important or of rather large size.

Bulk of Material in Small Orders

The great bulk of material, however, is purchased on orders running from a few dollars to a few thousand dollars. These orders are both large in total volume and relatively still larger in the amount of engineering detail involved. They necessarily receive scant attention on the part of the managerial staff and not a great deal more on the part of the engineering executives whose time is greatly overtaxed by the most important orders.

Inefficiency in selling to the large organization is very common—in fact, almost universal—among the small manufacturers and exists at times among the large manufacturers. This is generally the result of lack of knowledge regarding buying methods or of improperly directed enthusiasm on the part of the salesman.

Salesman's Approach

A salesman approaching a large corporation should investigate and satisfy himself that the company can use, and in fact needs, his product. He should understand that selling to such a company is a large job, and unless he is satisfied by his preliminary investigation that there is a considerable business available and that his product will be satisfactory, he should let this business alone. Such business should be classed as border-line selling and could more profitably not be followed up. But once satisfied that the prospective customer is possibly a substantial one, the salesman should proceed to sell to the company or find out why. If he persists until he finds the reason for his failure, he is well on the road to capturing a good customer. A few hints are here given to aid the salesman, and an actual case of a large construction company doing many millions of dollars' worth of work per year is chosen as an illustration.

How Orders Originate

All purchase orders originate in the offices of the division engineers. Wherever possible, these various orders, originating in the engineering divisions, are correlated to form a large order, which is handled by the technical specialists as cited above. Most of the orders, however, are handled by the division engineers with very little supervision.

Detail engineering and all purchase orders are carried out in subdivisions of the engineering department under division engineers. These division engineers are pretty thoroughly conversant with the work in their own divisions and are kept more or less acquainted with the work in the other divisions by the co-ordinating efforts of the technical specialists in engineering and materials, by the managerial specialists in co-operation of effort, and by general and department meetings and conferences held more or less frequently.

The great bulk of all detail engineering and detail purchasing originates with the engineering assistant, working under the division engineer. This account gives only a very general outline of the structure of the engineering department, but will serve to show the salesman that in order successfully to sell to such a company he must be thoroughly familiar with the organization and personnel of the engineering department, making sure that all engineers through whom orders for his material originate are thoroughly familiar with, and especially know the alleged advantages of, his product.

The Specifications

All material which is continually being purchased or is bought on very large orders is usually bought under general or detail specifications. These specifications serve a number of functions:

First—They tend to standardize the product (a) as to dimensions, (b) as to physical characteristics. All parts bought under the specifications will thus be interchangeable.

Second—They provide a common base on which all bidders may quote and so provide a base on which to judge price.

Third—They provide a standard by which the product may be judged when it is inspected for acceptance at the factory or on the "site."

Fourth—They tend to avoid misunderstandings as to just what the customer wants or what the manufacturer may supply.

The prospective salesman should secure a copy of all specifications pertaining to his material, should become thoroughly familiar with every detail of these specifications himself and should not rely solely on his factory for advice pertaining to them. If these specifications are either unfair to his product or partial to another's product, he is the man who must "smoke out" the situation; if his reasons are good he can have this difficulty corrected.

The Approved Bidder

For all material which is either bought on a large order or continually being purchased there will be a written or unwritten list of approved bidders. For the sake of competition the purchaser will try to have at least three bidders, and for the sake of simplicity and efficiency he will want to limit his list to as few in excess of this number as is consistent with good buying. The list of approved bidders is continually changing, since those suppliers who either ship inferior goods, consistently submit high prices or make poor deliveries are stricken from the list; but the list never loses the name of a supplier who gives good service.

This item "good service" is very general, but it covers the following:

First—Prompt quotations. If the salesman cannot get quotations on practically all small material to the purchaser by return mail, he should not go after this class of business. He should also be willing to give good service when the engineer merely wants this information for estimating.

Second—Keeping in touch with his factory. When he takes an order on which he knows the time of delivery is short and the meeting of shipment is most important, the salesman should follow this order and notify the engineer involved in case the delivery is delayed. A salesman must keep in mind that in the construction field a job must not be held up for lack of any material and the engineer must produce missing articles on time, almost regardless of cost. The most essential feature in "selling" the large corporation is to have a thorough knowledge of the job.

The Purchasing Department

After the salesman has satisfied the engineer that his product is the "best buy," he must remember that the order must pass through the purchasing department. In this department it will

Value of Electrical Exports for November, 1926, Compared with Corresponding Month in 1925

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	November 1925	November 1926
Generators:		
Direct-current:		
Under 500 kw.	$67,606	$111,083
500 kw. and over	81,496	12,746
Alternating current:		
Under 2,000 kva.	7,835	21,225
2,000 kva. and over	282,346	
Steam turbo-generator sets	9,397	352,191
Accessories and parts for generators	160,728	123,373
Self-contained lighting outfits	121,293	124,540
Batteries:		
Flashlight batteries	76,916	203,062
Other primary batteries	100,646	161,355
Storage batteries	181,002	301,132
Transforming or converting apparatus:		
Power transformers	67,354	338,873
Other transformers	104,994	108,273
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	43,931	106,151
Transmission and distribution apparatus:		
Switchboard panels, except telephone	264,571	103,413
Switches and circuit breakers over 10 amp.	174,139	177,103
Fuses and fuse blocks	29,502	35,357
Watt-hour and other measuring meters	51,576	49,412
Volt, watt and ampere meters and other recording, indicating and testing apparatus	118,327	213,461
Lightning arresters, choke coils, reactors and other protective devices	35,593	70,824
Motors, starters and controllers:		
Motors under 1 hp.	136,329	180,775
Stationary motors:		
1 to 200 hp.	269,882	311,190
Over 200 hp.	73,216	47,487
Railway motors	57,186	84,706
Electric locomotives:		
Railway	185,100	22,904
Mining and industrial	19,955	144,906
Starting and controlling equipment:		
For industrial motors	93,678	156,701
For electric railway and vehicle motors	3,455	17,843
Portable electric tools	*	52,874
Accessories and parts for motors	134,128	172,983
Electric appliances:		
Electric fans	32,261	66,623
Electric lamps:		
Metal filament	92,007	128,913
Other electric lamps	17,952	34,482
Flashlights	95,635	175,671
Searchlights and projectors	61,410	102,380
Motor-driven household devices	90,060	135,617
Domestic heating and cooking devices	109,879	231,504
Industrial electric furnaces and ovens	32,269	46,736
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	116,018	140,956
Signal and communication devices:		
Radio apparatus	1,277,060	†
Transmitting sets and parts	*	130,421
Receiving sets	*	463,208
Tubes	*	80,678
Receiving set components	*	210,303
Receiving set accessories	*	350,663
Telegraph apparatus	41,368	113,084
Telephone apparatus:		
Magnetic telephones	11,719	12,531
Other telephones	37,851	31,960
Telephone switchboards	5,020	83,510
Other telephone equipment	142,367	245,051
Railway signals, switches, and attachments	51,145	56,002
Bells, buzzers, annunciators and alarms	12,712	19,173
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	210,075	108,282
Insulating material	89,881	104,184
Metal conduit, outlet and switch boxes	83,486	88,535
Sockets, receptacles and lightning switches	138,302	172,643
Electric lighting fixtures, interior and street	154,289	167,693
Other wiring supplies and line material	169,081	78,706
Other electric apparatus, not elsewhere stated	563,993	653,884
Rubber and friction tape	*	35,947
Globes and shades for lighting fixtures	37,834	46,966
Electrical glassware except for lighting	13,253	53,897
Electrical porcelain:		
For less than 6,600 volts	102,257	38,778
For 6,600 volts and over	25,282	45,544
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	174,784	107,908
Other carbon products	81,567	150,592
Insulated wire and cable (iron and steel)	28,538	17,296
Copper, bare wire	93,438	170,665
Copper, insulated wire and cable	638,332	355,113
Total electrical machinery and apparatus and supplies	$7,793,306	$9,072,042

*Not separately stated prior to Jan. 1, 1926.
†Discontinued from Jan. 1, 1926.

not do the salesman any good to talk quality of product or any engineering advantage—in fact, such arguments will quite likely be ruled out. It is probable that the purchase will be made on a price basis. All advantages which the salesman's product may enjoy over his competitor's product must have been sifted cut and capitalized in the engineering department. These advantages will weigh either for or against the salesman in the purchasing department, in the form of a price differential in his favor or against him. The salesman must remember that the actual purchasing will be done by a purchasing agent who counts dollars and cents most important. The salesman must analyze his product and reduce its advantages to a dollar-and-cents basis, and try to persuade the engineer to accept this differential in his favor.

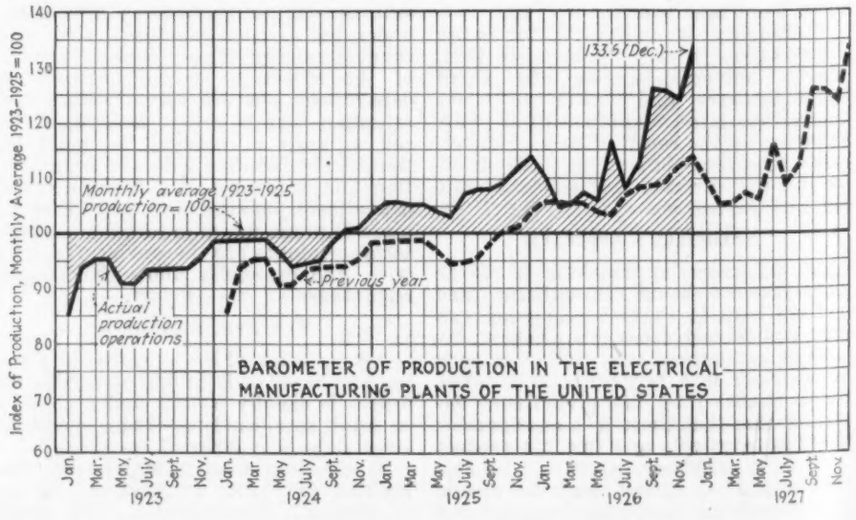
Except in the case of large orders which are placed on contract and in which the purchasing agent is actually the buyer and has the principal part in dealing with the salesman, virtually all orders are written in the engineering department and pass through the purchasing department to the seller unchallenged. The salesman should remember, however, that every order is subject to very careful study in the purchasing department, and the engineer must be prepared to defend every move he makes with the weapons of dollars and cents, in case any order is challenged by the purchasing department. Any price advantage which a product possesses must, therefore, be fully justified, and where the salesman expects to receive consideration with a differential in price, he must be sure that he has offered the engineer every possible reason why such a consideration should be allowed.

Peak Operations in December

Electrical Manufacturing Plants Report December Production Operations 17 per Cent Over December, 1925

THAT the peak of production operations in the electrical manufacturing plants of the nation was reached in December is indicated by reports received by the ELECTRICAL WORLD from a large percentage of these plants in all sections. The December production operations were about 17 per cent over those reported for December, 1925, and 7.5 per cent over November, 1926. These high rates of activity were recorded by both large and small manufacturing plants scattered throughout the country. Such is the picture of production operations in electrical manufacturing plants based upon the consumption of electrical energy by a large proportion of them.

The ELECTRICAL WORLD here presents in a new form this information on the operations of the electrical manufacturing plants. Heretofore the monthly operations, after seasonal variation computations, have been referred to a normal based upon the estimated growth of the industry. The barometer as now presented is uncorrected for seasonal variation or industrial growth, the monthly operations being referred directly to the monthly average for the three-year period 1923-1925. In the barometer as revised it is possible to compare directly the operations of one month with the previous month or months and with the same month of the previous years, as well as with the average operations for the three-year period 1923-1925. It is believed that in this revised form the



barometer will prove of larger value to the industry.

Reports received for the month of December indicate that the production operations of the industry were 7.3 per cent over those of November. A portion of this increase was to be expected, since December had two more actual working days than November. A very significant fact, however, is that last December's operations were 17.2 per cent above those of December, 1925. What proportion of this increased production was due to the natural growth of the industry and what production to the comparative capacity operations of the industry this year and last is, of course, problematical. The increase, however, from December, 1924, to December, 1925, was 9.5 per cent, as against the 17.2 per cent increase from December, 1925, to December, 1926. The figures point to a very prosperous condition in the electrical manufacturing plants of the country.

These high productive operations are of a higher order than was indicated in reports by American industry in general. General industry during December was operating at 5.5 per cent under November and slightly below the operations of December, 1925. The rolling mills and iron and steel plants were operating at 2.3 per cent below November, the textile plants at 0.1 per cent below November, and the automobile plants reported operations 35 per cent under those of November. The electrical manufacturing plants, therefore, were operating materially above the rate of activity reported by most of the primary industries during December.

Business Conditions

AN UNUSUALLY large volume of negotiations is reported by manufacturers, who declare that price competition is keen. New England and the entire Pacific Coast report excellent or, at least, good sales during the past week, with a roseate outlook. Other sections of the country, like the New York district, the Southeast and the Middle West, declare that inquiries involving large amounts are being received but that actual buying is dull. Decided optimism prevails. An especially large number of negotiations cover substation or switching equipment.

Outstanding pending business includes switching equipment for a railroad electrification job involving $200,000. A central-station company in the East is now asking for quotations on substation equipment involving more than $500,000. Another company in Illinois plans early erection of substations for which a similar amount of equipment will be purchased. Quotations on indoor switching equipment for a Pennsylvania water-power development have already been furnished by manufacturers, and an early release of specifications covering its outdoor equipment requirements is expected.

Receipt by one manufacturer of 41 inquiries in one week from bituminous-mine operators for information regarding mine locomotives and other electrical equipment indicates pending activity in this field. Renewal of purchasing interest is shown by Northwestern pulp, paper, lumber and shingle mills as well as by Alaskan canneries, mills and mines. More than 40 electric trucks are involved in three orders just executed, or about to be, in the southeast.

Lower Metal Prices Except for Copper

London quotations have suffered a drastic decline in the last few days, and this weakness has been reflected on this side. At the lower prices obtaining for lead, tin and zinc, a good business has been booked, as it was felt that the price recession was somewhat overdone. Copper sellers have maintained last week's prices for the most part, though some have made slight concessions without, however, attracting any buying worthy of the name. Present prices for copper, lead and zinc are the lowest since 1924. Silver has given a good account of itself again, keeping consistently above 56 cents, and antimony is slightly higher owing to expected difficulties with Chinese shipments.

NEW YORK METAL MARKET PRICES

	Jan. 19, 1927 Cents per Pound	Jan. 26, 1927 Cents per Pound
Copper electrolytic	13¼	13¼
Lead, Am. S. & R. price	7.65	7.40
Antimony	14⅛	14⅛
Nickel, ingot	35	34
Zinc spots	6.80	6.80–6.85
Tin, Straits	66⅛	65¼
Aluminum, 99 per cent.	27	26

Base copper price Jan. 26, 1927, 15¼ cents.

The large producers of copper are uniformly out of the market, generally quoting 13⅜ cents in the East and 13¼ cents in the Middle West, at which levels no business was possible all week. Smaller sellers have shaded these prices by one-eighth cent, but even at that have been able to do practically nothing.

On Jan. 20 a cut of $3 per ton for lead brought the price from 7.65 cents to 7.50 cents, and on Jan. 25 a further cut of $2 made the price basis 7.40 cents per pound.

Active Buying in New England

In most lines of electric supplies and equipment, with the exception of power equipment, an encouraging activity is reported in this district. During the past week central-station supplies were in good demand and orders for control and switch equipment were placed for western Massachusetts and Rhode Island plants. A number of orders for replacement of general stock for central stations were also booked. One manufacturer reports that budgets covering new construction requirements for this district show favorable demands for central-station supplies during the coming year. Negotiations are now under way for a good volume of power distribution and transmission needs. Industrial electric heating is very active and manufacturers are receiving orders. During the past week a notable electric baking installation, consisting of two 600-kw. ovens, one of the largest applications in the country, was closed for Somerville. Street lighting is active. One prominent central station syndicate is conducting investigations for improved steam-railroad station lighting. A group of large central stations in this district expects to double its 1926 mercantile and industrial lighting consumption.

Large Inquiries in East Despite Lull in Buying

Numerous inquiries for substation, switching and mining equipment in considerable magnitude have occurred in the East during the past week, although actual buying has been dull in virtually all lines. One utility asked for quotations on substation equipment involving more than $500,000. Quotations on indoor switching equipment have been furnished a Pennsylvania water-power company which is expected to give early release on specifications for outdoor equipment. Signs of forthcoming equipment buying in the bituminous-mine field are afforded by the fact that one manufacturer received 41 inquiries regarding mine locomotives or electrical mine equipment last week. Some activity is reported among local railroads, and some inquiries for switches, etc., were received from this source during the past few days. Jobbers report a fair demand for conduit, fittings, etc., but appliances are weak.

Although the demand for substation apparatus and transformers continues fair, a general falling off of sales to central-station companies is reported by most manufacturers in the New York district since the early part of the month. Demands for switches, circuit breakers, poles, cross-arms and hardware were dull during the past week. The demand for motors for general purposes is quiet, sales being limited generally to the small sizes. Control apparatus is also inactive.

Inquiries Stronger than Orders in Southeast

Inquiries rather than orders seem to have been the feature of electrical activities in the Southeast last week, though some reasonably good business was reported. One manufacturer reports the receipt of an oil-switch equipment order amounting to $70,000, and the past two weeks have witnessed the placing of some smaller orders for manual-control and air-break disconnecting switches. Inquiries were received last week on two turbo-generator units of 15,000 kw. each, and orders for this equipment will undoubtedly materialize within the next six months. Industrial-truck battery lines are reported active, one recent order from the Birmingham district amounting to $4,000, and an order for $8,000 worth of these batteries is in immediate prospect. One large firm in the territory is in the market for a fleet of electric trucks,

and indications are that sixteen trucks will be ordered within a reasonable length of time. Orders were received last week for twenty industrial trucks for Savannah and six for Birmingham.

Construction contracts were let last week on two jobs, one of which will call for approximately $60,000 worth of electrical materials and the other for $35,000 worth. Orders for these materials will probably be placed in the very near future. Considerable interest is being displayed in street lighting. One manufacturer of "white-way" equipment in the Birmingham district reports that his entire production of posts for some time to come is already contracted for. Industrial plants are still confining themselves largely to price inquiries, but all evidences, however, are that actual orders will begin to be placed in the near future. Inquiries from textiles lead the field, with mining interests in the Birmingham district and lumber interests in Mississippi and Louisiana following closely.

Excellent Business on Pacific Coast

Power apparatus and machinery orders bulk large in this week's orders, owing chiefly to the placing of orders for the California-Oregon Prospect No. 2 plant and the Don Pedro plant of the Turlock irrigation system. For the first plant there has been ordered a 24,500-hp. vertical reaction turbine complete with hydraulic equipment, the cost totaling $70,000. The equipment is for installation late in 1927. For the second plant one manufacturer reports orders for two 9,370-kva., 70,000-volt transformers, a 2,500-kva. motor-generator set and a 70,000-volt transformer, totaling approximately $80,000.

Other large orders include four 650-hp. synchronous motors for a cement plant, which complete with incidentals are valued at $36,000; a carload of about 2,500 house-type watt-hour meters for the Bay territory, $7,000 worth of steam-turbine parts for Sacramento, and twelve 100-kva. subway transformers valued at $8,000.

Manufacturers report a good market for commercial sizes and types of motors from 1 hp. to 50 hp. Other power-company buying is confined to wiring material, though some very large bids are reported, including 3,000 35-ft. poles valued at about $35,000.

Prices in all lines except on bare and insulated copper wires are gradually growing firmer. Dealers' stock orders are better.

Northwest Industries Becoming More Active

Indications are that sales volume in motors and the heavier apparatus will be exceptionally good during the spring and summer months. Pulp and paper mill projects, some in preliminary stages and others underway, are commanding attention. Lumber and shingle-mill buying is at minimum, although several electrification jobs are being planned and specifications for equipment for two or more projects are now being written. Alaska cannery buying, involving motors, pumps, etc., has started, and several Seattle jobbers report sales of consequence during the past ten days. Mills and mines in Alaska also have started buying for replacements and proposed additions.

One Seattle firm reports the sale of $5,000 worth of motors, ranging from 150 hp. down, for a lumber mill in southeastern Alaska. Other orders reported involve $3,000 worth of motors from 75 hp. down for a pulp and paper mill, and a 60-kva. alternator, switchboard and accessories, and twelve motors from 100 hp. down for a theater. The city of Seattle will buy two 10,000-kva. transformers, one high-tension and two 25,000-volt oil circuit breakers and related equipment.

Middle West Somewhat Dull, but Optimism Prevails

Business in the Middle West this week appeared somewhat slower. While no marked recession of trade was noticeable, it was not up to expectations. A feeling of optimism still prevails. In the utility field a marked activity is noticeable, as evidenced by the purchases of one large utility company, which averaged over $167,000 per day.

Among the interesting orders placed this week was one for 54 12,000-volt reactors and another for ten 200-kva., single-phase and nineteen three-phase, 112½-kva. to 450-kva. subway transformers. Manufacturers of pole-line hardware report a slight decrease in business. Electrical jobbing business also was quiet. There has been a good demand for appliances, particularly toasters, one manufacturer having sold some 12,000 in the Chicago territory recently. Washing machines have moved fairly well, one jobber placing a single order for 500 machines this week. Prices remain generally firm. A price recession on Mazda lamps becomes effective Feb. 1, according to reports.

The first three weeks of 1927 have not indicated what the business of the year is to be in the territory centering around St. Louis. All industrial plants are working regularly, but at present they are buying in a hand-to-mouth fashion. Whatever expansion they may have in mind, they are not ready to place orders for material.

Activities of the Trade

Salesmen for North East Company Meet at Rochester

Salesmen from all of the domestic branches of North East Service, Inc., the distributing organization of the North East Electric Company, met at the general offices in Rochester, N. Y., for a convention Jan. 24 and 25. Plans for marketing the company's products were discussed, and the program included addresses by Edward A. Halbleib, vice-president and general manager North East Electric Company, and R. J. Kelleher, general manager of North East Service, Inc. Warren K. Lee, sales manager, was in charge of the sales features of the convention. An accounting system for service stations and the company's advertising policy for the coming year constituted two other topics of discussion.

Westinghouse Company Gets Large Transformer Orders

Two contracts, covering four 33,333-kva. transformers and seven 25,000-kva. transformers respectively, for the Southern California Edison Company have been placed with the Westinghouse Electric & Manufacturing Company. These units will be manufactured at the Sharon works for delivery during the coming spring and summer. The 33,333-kva, units are the largest single-phase transformers to be built from the standpoint of kva. capacity, surpassing the 31,400-kva. units also manufactured by the Westinghouse company. All of these units are to be single-phase, self-cooled, of the air-blast type, and are for use on the 220,000-volt system of the Southern California Edison Company. The 33,333-kva. transformers go to the new Sunset steam plant of the California company, for which Stone & Webster of Boston have acted as consulting engineers. The seven 25,000-kva. transformers go to the Lighthipe substation and will be used to connect 220,000-volt and 60,000-volt transmission systems. They are similar in construction to the four larger units.

Plan to Increase Servel Stock

Stockholders of the Servel Corporation will be asked at a meeting to be held Jan. 31 to approve the directors' proposal that the present authorized amount of the company's capital stock, namely, 1,000,000 shares of no par common, be increased to 1,300,000 shares.

Upon authorization of increase by stockholders there will be offered to stockholders of record Feb. 3 the right to subscribe at $10 a share for approximately 196,000 shares of stock at the rate of three and one-half shares for every ten held. Subscription rights must be exercised and payment for subscribed stock made on or before Feb. 18. Stockholders exercising their subscription rights will also receive stock purchase warrants to purchase on and after April 1, 1927, one-half additional shares for each subscribed share, at $11 a share on or before April 1, 1928, and thereafter, at $15 a share on or before April 1, 1929.

Options now outstanding on 200,000 shares, given in connection with the issue of the five-year 6 per cent convertible notes, the purchase of certain properties and the profit-sharing plan for compensating officers of the company, will be surrendered by holders without cost to the company.

Master Electric Company Holds Sales Convention

A sales convention which was attended by all the district managers, factory representatives, agents and distributors east of the Mississippi River

was held early this month by the Master Electric Company at its factory in Dayton, Ohio. A large part of the two days devoted to the convention was used in discussing sales plans for the new year and the explanation of a large number of quality refinements that have been made by the company both in its manufacturing processes and in its product. E. P. Larsh, president and general manager; W. R. Clements, vice-president and sales manager; R. E. Blackford, superintendent, and George A. Arnold, advertising and sales promotion manager, all gave interesting talks. At the convention prizes were awarded to winners of the 1926 sales contest.

Copeland Products Reports Large Increase in Sales During 1926

Close to 1,000,000 electrical refrigerators will be installed during 1927, according to the estimates of W. R. Wilson, president of Copeland Products, Inc., Detroit. The company states that approximately 350,000 units were sold in the United States during 1926. Mr. Wilson says that his organization showed the largest percentage increase in sales during 1926 made by any manufacturer of electrical refrigerators and that the organization has been increased month by month to keep step with the increased sales. He also said that last fall the Copeland factories were kept running with a large number of orders and that actually the sales staff showed an increase in business during the fall and winter months over that gained during the spring and early summer. Basing its estimates on the increased sales, the company has raised its 1927 quota and increased its organization, and it is now prepared to give its dealers and distributors increased selling help by assigning more factory-trained men to their particular territory.

The Bussman Manufacturing Company, 3819 North Twenty-third Street, St. Louis, manufacturer of fuses and portable lamps, has purchased the five-story brick building at 2536 University Street. The company announces that the building will be remodeled and will provide the company with more than double its present office and factory space.

The Trico Fuse Manufacturing Company, Milwaukee, announces that considerable additional facilities adjoining the present plant have been secured and that new machinery and special equipment are now being installed.

The Burke Electric Company, Erie, Pa., manufacturer of motors, generators and welding equipment, announces the appointment of H. C. Lemire, 407 South Fourth Street, Minneapolis, as district sales agent for Minnesota, the Dakotas and the northern portion of Wisconsin.

The MacGillis & Gibbs Company, Milwaukee, producer of Northern white and Western red-cedar poles, announces that E. W. Rockafellow, who for the past three-and-a-half years has been acting as vice-president for the National Pole Company of New York, is now representing the company in New York and will act as its Eastern manager. Mr. Rockafellow, prior to his connection with the National Pole Company, was for many years general supply sales manager of the supply department of the Western Electric Company, now known as the Graybar Electric Company.

The National Electric Manufacturers' Association, 30 East Forty-second Street, New York, will move from its present quarters to the new Graybar Building, east of the Grand Central Terminal, about April 1, when the building is completed.

The Electric Refrigeration Corporation, Detroit, through the Kelvinator division, announces that because of new production economies it is able to put in effect lower prices on its "Kelvinators" for 1927. The new prices include all installation charges, except wiring, and represent a reduction in many models. At its annual meeting of stockholders in Detroit the company re-elected its directors. A. H. Goss, president, said that the company had 3,200 stockholders.

The Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago, announces that all rotating bearings on its equipment are now being fitted with standard "Alemite" grease fittings and that before shipment each bearing is completely filled.

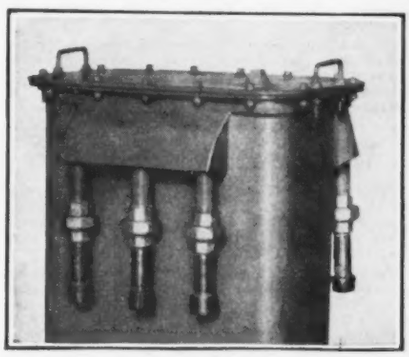
The National Lamp Works of the General Electric Company, Nela Park, Cleveland, have appointed N. H. Boynton, formerly general manager of the Buckeye division, as assistant sales manager. C. B. Gray, who was assistant to Mr. Boynton, has been promoted and will be the new manager of the Buckeye division.

The Pierce Electric Company, Tampa, Fla., jobber, has moved into its new three-story plant at 710 Bell Street.

New Equipment Available

Subway-Type Transformers

A line of subway-type transformers has been developed by the Packard Electric Company, Warren, Ohio. The smaller sizes are built in all-steel tanks with bolted covers which have handles for lifting. Between the lid and the tank is a "velumoid" gasket, and all bushings are fitted with unions and nipples for making a wiped-joint connection with the lead-cable sheathing. The general characteristics of these subway-type transformers are the same as those of Packard pole-type distribution transformers.



SUBWAY-TYPE TRANSFORMER WITH ALL-STEEL TANK

Arc-Welding Equipment

An arc welder for use in production and repair welding of cast and malleable iron and steel parts has been placed on the market by the New Monarch Machine & Stamping Company, Des Moines, Iowa. This equipment uses alternating current and is self-cooled. The manufacturer claims that cast iron can be welded with facility. The equipment is simple, and it has intense penetration and a highly developed system for regulating the temperature of the arc. The welder is made up of a series of impedance coils, which are of annealed steel containing manganese. The coils are said to provide an even flow of current and are of sufficient resistance to give a strong and steady arc. There are thirteen impedance coils arranged around two steel bands. They are connected with power plugs arranged on the front of the sheet-steel casing, each plug giving service from a certain set of coils, as desired by the operator. There are no moving parts in the welder. An electrode holder, which may be used on any length of cable up to 500 ft., is provided. The weight of the equipment is 275 lb., and the space occupied is 3 cu.ft.

Electric Furnace

A revolving retort-type electric furnace has been placed on the market by the W. S. Rockwell Company, 50 Church Street, New York. The parts to be heated are delivered in bulk to a hopper at the charging end fed automatically into an alloy metal retort through which the pieces are moved toward the discharge end in a continuous stream by a spiral, moving on the hot casting with a slow, rolling action. Each piece is thus exposed individually at a uniform temperature in the same manner, at the same rate and at the same time. Cooling by quenching is accomplished in the same manner with a rotary quenching tank.

The furnace for non-ferrous metal parts has a capacity ranging from 1,500 lb. to 2,000 lb. an hour and provides a connected load, ranging from 75 kw. to 100 kw., varying with the capacity and the temperature, which is held within close limits by an automatic control device. For heat-treating steel products similar furnaces are available with capacities ranging from 200 lb. to 1,000 lb. an hour and with connected loads ranging from 50 kw. to 150 kw.

Variable-Speed Driving Gear. — The "P.I.V." driving gear, described in the issue of Dec. 4, 1926, is being manufactured by the P.I.V. Gear Syndicate, Ltd., 7 Princes Street, Westminster, London, S.W.1, and was not developed by David Brownlie, as stated in the article.

New Trade Literature

ELECTRIC FANS.—"New Fans in the Robbins & Myers Line" is the title of bulletin 1,318 distributed by the Robbins & Myers Company, Springfield, Ohio, in which are described the various types of the "R & M" desk, wall and ceiling fans.

MULTIPORT VALVES. — Catalog No. 1,381 issued by the Cochrane Corporation, Seventeenth Street below Allegheny Avenue, Philadelphia, covers the Cochrane "Multiport" valves. The catalog is well illustrated and the various applications are fully described. Chapters are devoted to atmospheric relief valves, remote control for back-pressure valves, flow valves for mixed-flow turbines, steam check valves, foot valves, etc. Tables giving the discharge opening as compared with single-disk valves and complete dimensions of the various types are included.

LIMIT SWITCH.—The Electric Controller & Manufacturing Company, 2700 East Seventy-ninth Street, Cleveland, is distributing bulletin No. 1037-C, describing the "EC&M" type "B" limit stops for alternating-current and direct-current motors. Tables giving the rating and weights of the type "B" limit stops for both direct-current and alternating-current circuits are included.

HAND-STARTING COMPENSATORS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-570, describing its CRI0134-K17, -K21 and -K22 hand-starting compensators for starting polyphase squirrel-cage induction motors, driving pumps, conveyors, compressors, blowers, etc.

ELECTRIC RANGE. — The New Era Electric Range Company, 50 East Forty-second Street, New York City, is distributing a bulletin describing the New Era electric range. An illustration calls attention to the advantage and shows details of construction of the range.

ELECTRIC EQUIPMENT FOR PAPER MACHINES.—"Sectional Drive for Paper Machines" is the title of bulletin GEA-527 issued by the General Electric Company, Schenectady, N. Y., in which it describes the General Electric equipment for sectional paper machine drive (regulator type). Attention is called to the salient features of the drive and the advantages of sectional drive. Illustrations showing typical installations of sectional drive on paper machines and a control switchboard for sectional paper machine drive are included.

PORCELAIN MOUNTINGS.—The James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, is distributing bulletin No. 316, describing its convertible and interchangeable mountings for mounting the Kearney expulsion porcelain plug cut-out. Attention is also called to the Kearney fuse puller.

AUTOMATIC COMPENSATORS. — Bulletin 1042-F issued by the Electric Controller & Manufacturing Company, 2700 East Seventy-ninth Street, Cleveland, describes the "EC&M" automatic compensators for 110-volt to 550-volt alternating-current squirrel-cage and synchronous motors. It contains ratings, outline dimensions and weights of the automatic compensators. Illustrations showing typical installations are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Johannesburg, South Africa (No. 23,697), for storage batteries.

Purchase and agency are desired in Paris, France (No. 23,736), for electrical household appliances.

An agency is desired in Alexandria, Egypt (No. 23,751), for radio sets and parts and wiring materials, particularly wall switches.

An agency is desired in Marseilles, France (No. 23,686), for radio sets and parts.

An agency is desired in Oshawa, Ontario, Canada (No. 23,699), for radio sets and parts.

An agency is desired in Stuttgart, Germany (No. 23,698), for copper wire.

An agency is desired in Bagdad, Iraq (No. 23,700), for wiring devices and appliances; also hardware and tools, especially tools for electrical trade (No. 23,748).

Purchase is desired in Durango, Mexico (No. 23,703), of hydraulic turbine power plant complete.

Purchase is desired in Guayaquil, Ecuador (No. 23,739), of electrically operated cardboard box-making machinery.

TENDERS ASKED FOR TELEPHONE EQUIPMENT FOR AUSTRALIAN GOVERNMENT.—Tenders will be received by the Postmaster-General's Department, Melbourne, Australia, until March 8 for induction coils and registers. Tender forms, specifications and drawings covering this equipment have been forwarded to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., which can be seen by firms interested by communicating with Electrical Equipment Division, mentioning EE No. 1026.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SPRINGFIELD, MASS.—The City Council is considering a report submitted by E. H. Lochridge, chief engineer, for a proposed municipal hydroelectric plant on the Little River, to cost about $3,000,000.

BRIDGEPORT, CONN.—Bids will soon be asked by the Connecticut Company, New Haven, for the construction of a local substation. R. W. Foote, New Haven, is architect.

STRATFORD, CONN.—Bids will soon be asked by the Connecticut Company, New Haven, for the construction of a local substation. R. W. Foote, New Haven, is architect.

Middle Atlantic States

ANDOVER, N. Y.—Plans are under way by the Niagara, Lockport & Ontario Power Company, Buffalo, for additions to its local plant and extending its transmission line to Andover, to cost about $300,000.

BEACON, N. Y.—Bids will be received by the Commissioner of Mental Hygiene Department, Department of Hygiene, Capitol, Albany, until Feb. 9, for construction, heating, sanitary and electric work, central power plant, Matteawan State Hospital, Beacon.

FIRE ISLAND, N. Y.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, until Feb. 2, for radio towers for the local naval radio compass station (Specification 5314).

NEW YORK, N. Y.—Bids will be received by A. Goldman, Commissioner Department of Plant and Structures, Municipal Building, until Feb. 14, for electrical equipment for destructor plant at East Seventy-third and Exterior Streets, for Department of Street Cleaning.

NEW YORK, N. Y.—Construction expenditures on properties of Fitkin utilities in 1927 will approximate $28,000,000, according to C. A. McCullough, construction manager of the General Engineering & Management Corporation, 165 Broadway. About $20,000,000 will be expended for major improvements, such as new power houses, hydro-electric developments, transmission lines, substations, gashouses, mains, ice plants, etc. The remaining $8,000,000 will be used for minor improvements.

UTICA, N. Y.—The Utica Gas & Electric Company has applied for authority to extend its transmission lines and distributing system in the town of Marshall.

WHITE PLAINS, N. Y.—The New York Central Railroad Company, New York, plans to construct a substation here.

ORANGE, N. J.—The City Commission has engaged Frederick O. Runyon of Runyon & Carey, engineers, 843 Broad Street, Newark, to submit estimates on the cost of installing an ornamental lighting system on Main Street, and to make a survey of the traffic conditions with a view to installing a traffic control system.

BEDFORD, PA.—Plans are under way by the American Telephone & Telegraph Company, 195 Broadway, New York, for the establishment of a local technical school, with laboratory, construction and repair shops, etc., to cost about $100,000.

GLASSPORT, PA.—The installation of new street lamps on Monongahela Avenue is under consideration by the Glassport Business Men's Association.

MOUNT HOLLY SPRINGS, PA.—The Cooke-Cumberland Light & Power Company, recently organized with headquarters here, is considering the erection of a transmission line. The Dickinson-Cumberland Light & Power Company, an affiliated organization, also plans to build a power line. J. H. Bucher, Boyertown, is treasurer.

PHILADELPHIA, PA.—A permit has been granted the Philadelphia Electric Company to construct a substation at Twenty-fourth and Washington Streets to cost about $125,000.

ROANOKE, VA.—Plans for the proposed local factory of the Johnson-Carper Furniture Company, recently formed by G. W. Hooker, Shenandoah Life Building, and associates, to cost about $400,000 include a power plant.

WASHINGTON, D. C.—Bids will be received by A. L. Flint, general purchasing agent, the Panama Canal, until Feb. 11, for an electric hydraulic dredge and equipment.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Feb. 1, for a quantity of wire and cable for eastern and western yards (Schedule 6607).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Washington, until Feb. 7, for 500 head telephones, connecting blocks, transmitter buttons, etc. (Proposal C. P. 23867-1).

WASHINGTON, D. C.—Bids will be received at the office of the General Purchasing Agent, the Panama Canal, Washington, D. C., until Feb. 10, for an electric towing machine, suction pump, etc. (Circular No. 1782).

North Central States

SAGINAW, MICH.—Plans are under way by the Consumers Power Company, Jackson, for the construction of a new local office and service building to cost about $50,000. Albert Kahn, Marquette Building, Detroit, is architect.

AKRON, OHIO.—Bids will be received by the City Service Department, until Feb. 7, for the installation of an ornamental lighting system on Madison Avenue.

CINCINNATI, OHIO.—Plans have been filed by the E. Kahn's Sons Company, Poplar Street, for the construction of a power plant at its proposed packing house on Spring Grove Avenue. The entire project will cost about $2,000,000. Henschien & McLauren, Chicago, are engineers.

PHILO, OHIO.—The American Gas & Electric Company, 30 Church Street, New York, has purchased a 165,000-kw. steam generating unit for the Philo plant of the Ohio Power Company, Canton, a subsidiary. The cost of the installation of this unit complete with housing, boilers, high-tension transformer, etc., is estimated at about $17,000,000.

CLINTON, KY.—The Kentucky Utilities Company, Louisville, contemplates extensions in transmission lines in this section.

BORDEN, IND.—The local electric light plant, owned by W. R. Martin, was recently destroyed by fire. At present the town is without electrical service.

LOGANSPORT, IND.—The Middle West Utilities Company, 73 West Adams Street, Chicago, has awarded a contract to the U. G. I. Contracting Company for engineering and designing a hydro-electric development on the Wabash River, near Logansport, which will cost about $1,500,000. The construction work is not included in this contract.

ASHLAND, WIS.—The City Council is considering a petition asking for the installation of ornamental lamps on Seventh Avenue, between Second and Sixth Streets, to replace the arc lamps now in use.

CAMERON, WIS.—Plans for the proposed local creamery to be enacted by the Cameron Creamery Company, at a cost of about $300,000, include a power plant.

WAUSAU, WIS.—The Wisconsin Valley Electric Company contemplates extending its transmission line from Stevens Point to Buena Vista.

BELLINGHAM, MINN.—The West Light & Power Company, Waconia, which has acquired the municipal electric light and power plant, contemplates extension in its transmission lines in this section.

JARRETT, MINN.—Plans are being considered by W. B. Drury, owner of the old Colburn mill, for the construction of a hydro-electric plant, to serve Millville, Hammond and Zumbro Falls. Jarrett has not a post office.

MINNEAPOLIS, MINN. — The 1927 budget of the Northern States Power Company calls for an expenditure of more than $6,000,000 in Minneapolis, St. Paul and other points in Minnesota and in Wisconsin, Illinois, Iowa and North and South Dakota. The capacity of the Riverside steam plant in Minneapolis is to be increased by 10,000 hp., and the High Bridge station at St. Paul by 7,500 hp. About 1,500 kw. will be added to the Fargo station by converting it into a full condensing plant. The output of eight substations in the Twin Cities will be increased, four in Minneapolis and four in St. Paul, and additional distribution facilities will be provided. The substation at Mankato, Minn., will be rebuilt, and also 160 miles of transmission lines. Extensions are planned at Sioux Falls, S. D., Grand Forks, N. D., and Galena, Ill.

NEW ULM, MINN.—Plans are being prepared for extensions and improvements in the municipal electric plant, including installation of a 900-kw. generating unit, to cost about $50,000.

ST. PAUL, MINN.—The City Council has authorized a call for bids for the installation of ornamental lighting systems on portions of Carroll, Desnoyer and Glenham Avenues. Similar systems are proposed on Snelling Avenue, to cost about $30,000; and on West Seventh Street and Fort Snelling bridge approach, to cost $60,000. G. M. Shepard is city engineer.

MASON CITY, IOWA.—The People's Gas & Electric Company plans extensions in its steam-operated electric power plant, including installation of new equipment.

WEBSTER CITY, IOWA.—The City Council is considering the installation of a new turbine-driven generating unit and accessories in the municipal electric plant.

CARTHAGE, MO.—The Municipal Electric Light and Water Department is considering the construction of a new power plant on River Street, to cost about $50,000.

CHILLICOTHE, MO.—Bids will be received by the Board of Public Works, until Feb. 15, for a 1,500-kw. turbo-generator for the municipal power plant. E. E. Harper, 3031 Park Avenue, Kansas City, is consulting engineer.

FREDERICKTOWN, MO. — The Union Electric Light & Power Company, St. Louis, has been granted a franchise to furnish electricity in Fredericktown.

KANSAS CITY, MO.—Plans are being prepared by the American Sash & Door Company, Sixteenth and Bellfontaine Streets, for the construction of a power plant at its mill, to cost about $40,000. The Burns & McDonnell Engineering Company, Interstate Building, is engineer.

WICHITA, KAN.—Plans are under way by the Kansas Gas & Electric Company for the installation of a new 25,000-kw. generating unit in its Neosho plant, near Parsons, to cost about $1,100,000. The company is building a sub-surface cable system in Wichita, at a cost of about $1,000,000.

Southern States

ASHEVILLE, N. C.—Extensive improvements are contemplated by the Carolina Power & Light Company, Raleigh, to its local system, including extension to the street car service, erection of new car barns, to cost about $200,000, and erection of a 66,000-volt transmission line from Asheville to Spruce Pine.

WILSON, N. C.—Bonds to the amount of $25,000 have been authorized for extensions to the municipal electric light system.

EDGEFIELD, S. C.—The Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., which is negotiating for the municipal electric plant contemplates extensions in transmission lines in this section.

FORT LAUDERDALE, FLA.—The installation of a fire-alarm and fire protection system is under consideration by the city officials.

MIAMI, FLA.—Bids will be received by the Dade County Board of Commissioners until Feb. 15, for electric lighting fixtures and equipment for the new $2,000,000 court house, now in course of construction. A. Ten Eyck Brown, Huntington Building, Miami, is architect.

MIAMI, FLA.—Extensions and improvements contemplated by the Florida Power & Light Company, include extension of transmission and distribution lines to Vilano Beach, to cost $18,000; distribution system in Davis Shores, $17,000; feed and power lines for Matanzas Bridge, $5,000; street lighting line from Matanzas River bridge to St. Augustine, $10,000, and ornamental lighting system in St. Augustine, $100,000.

PENSACOLA, FLA.—The City Council has tentative plans for extensions in the ornamental lighting system in the business section.

ST. PETERSBURG, FLA.—Preparations are being made for the installation of new ornamental lighting systems (other than those under way) during 1927, to cost about $200,000.

TALLAHASSEE, FLA.—A license has been granted the West Florida Power Company to construct a hydro-electric plant on the Ocklocknee River. The plans provide for an initial installation of 12,000 hp.

NASHVILLE, TENN.—Extensions and improvements are contemplated by the Southern Bell Telephone & Telegraph Company during 1927, to cost about $5,000,000. The work will include new lines, cables, conduits, switchboards, exchanges, etc., in various parts of the state.

BIRMINGHAM, ALA.—Plans have been filed by the Birmingham Electric Company for the construction of a substation, at North Seventh Avenue and Twelfth Street.

GREENVILLE, ALA.—The construction of a pumping station is under consideration by the City Council instead of a municipal electric light plant as reported in these columns in the issue of January 8. Electrical service in Greenville is supplied by the Alabama Power Company, Birmingham.

GULFPORT, MISS.—The City Council is not considering the installation of a municipal electric plant as reported in these columns in the issue of January 8. The Mississippi Power Company furnishes electrical service in Gulfport.

LITTLE ROCK, ARK.—Plans are under way by the White Way Commission for the installation of an ornamental lighting system, covering ten blocks at present. It is proposed to install ornamental lamps on eighty blocks in the near future. The Arkansas Central Power Company has the contract for street lighting here.

MARRERO, LA.—The Celotex Company, 645 North Michigan Avenue, Chicago, plans additions in the power plant at its local insulating board mill in connection with a proposed extension to cost $500,000, in 1927.

BLAIR, OKLA.—The Southwestern Light & Power Company, Lawton, which has acquired the municipal electric plant, plans extensions in transmission lines in this section.

GRANITE, OKLA.—Plans are under way by the Southwestern Light & Power Company, Lawton, to extend its 23,000-volt transmission line to Granite, a distance of 11 miles, and to install a distribution system here. The cost is estimated at $40,000.

OKLAHOMA CITY, OKLA.—The installation of an ornamental lighting system on Robinson Avenue, similar to that on Broadway, is under consideration.

OKLAHOMA, OKLA.—Application has been filed with the Oklahoma Drainage Commission by Frederick and Devere Dierks, Kansas City, Mo., asking for a permit to construct a hydro-electric power plant on the Mountain Fork River in McCurtain County, to cost about $5,000,000. The project will include the construction of three separate dams to be 135, 185 and 35 ft. high respectively. The applicants now operate electric plants and transmission lines serving Broken Bow, Wright, Valliant and Idabel.

HENDERSON, TEX.—The electric system of the Henderson Light & Ice Company has been acquired by the East Texas Public Service Company, Marshall. The new owners plan improvements to the local plant and will connect it with its transmission system.

SAN BENITO, TEX.—The Valley Electric & Ice Company plans to install a lighting system in the Valencia Park district.

Pacific and Mountain States

CENTRALIA, WASH.—Steps have been taken by the Chamber of Commerce for the installation of a new street-lighting system in the downtown section of the city.

MEDFORD, ORE.—A preliminary permit has been granted the California-Oregon Power Company, San Francisco, covering five sites on the North Umpqua and Clearwater Rivers in Douglas County, Ore.

PORTLAND, ORE.—The construction program of the Portland Electric Power Company for 1927 provides for an expenditure of from $1,500,000 to $2,000,000, in the light and power department. Of this amount $600,000 will be used for overhead construction work in Portland and $200,000 for underground work in the city. For additional equipment for power stations, substations and improving operating conditions, between $460,000 and $470,000 will be required. New boiler equipment is under consideration for station "L", which if installed will cost about $250,000.

LOS ANGELES, CAL.—The Board of County Supervisors has authorized the installation of forty-nine ornamental lamps on Robertson Boulevard, using pressed steel standards.

MONTEBELLO, CAL.—The installation of ornamental lamps on Beverly Boulevard, covering a distance of about 3 miles, is under consideration.

ORANGE, CAL.—The Southern California Edison Company, Los Angeles, has acquired a site at Maple and Batavia Streets for a proposed substation to cost about $25,000.

POMONA, CAL.—The City Council is considering a petition for the installation of ornamental lamps on Second Street.

SAN FRANCISCO, CAL.—Approximately $20,000,000 will be expended by the Pacific Gas & Electric Company for construction work during 1927. This will include the preliminary work on the development at Salt Springs, which calls for a rock-fill dam, 220 ft. high, across the Mokelumne River, a reservoir, a 25-mile water conduit, 44,000-hp. generating plant at Tiger Creek, and increasing the capacity of the Electra power house from 26,000 hp. to 44,000 hp. Completion of the Melones power house. On the Spaulding-Dunn development the two Lake Spaulding plants are to be replaced by larger ones and a third plant is to be built, increasing the capacity of the Dunn power house from 50,000 hp. to 67,000 hp. A fourth plant is in contemplation. In the San Francisco division $500,000 is to be spent on new work, and the same amount in the East Bay division for transmission lines alone, and the same amount in the Sacramento division for rebuilding the Davis substation and other work, and the San Jose division $400,000 on the Newark-Coyote tower transmission line and $100,000 on a new substation at Monte Vista.

SANTA ROSA, CAL.—The City Commission is planning extensions in the ornamental lighting system.

STRATHMORE, CAL.—The Southern California Edison Company, Los Angeles, plans to build a substation here, to cost about $350,000.

BUHL, IDAHO—The People's Mutual Power Company has been granted a franchise to erect an electric distribution system in Buhl.

EPHRAIM, UTAH—The City Council contemplates the purchase of an engine-driven generating unit, to cost about $17,000, for the municipal electric plant. An alternative proposal is under consideration for an entirely new station, to cost $50,000.

Canada

VANCOUVER, B. C.—The construction program for 1927 of the British Columbia Electric Railway Company calls for an expenditure of about $5,000,000. It will include work on the Bridge River development, to cost about $1,500,000; projects in the Lower Mainland, including a new power line crossing at the Second Narrows, and the completion of the Alouette power plant at Stave Lake; placing power wires in the central section of the city underground system; extensions to the light and power system to meet increasing demands for electrical service in the city and surrounding municipalities, etc.

WINNIPEG, MAN.—Extensions and improvements are contemplated by the Hydro-Electric System of Winnipeg, to cost about $1,000,000. The work will include the enlargement of five substations, the installation of five new feeders to take care of the over load, and the erection of a substation in Transcona, to cost about $50,000. Tenders, it is understood, will be asked for transformers and circuit breakers, to cost about $500,000.

HAMILTON, ONT.—The Dominion Power & Transmission Company has plans for a new substation, for railway and power service to cost about $100,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 28, 1926)

1,612,330. PULSATING-TORQUE MACHINE: W. E. Trumpler, Wilkinsburg, Pa. App. filed Dec. 15, 1924. To combine two single-phase dynamo-electric machines into a single unit and to cause the reactive forces exerted by one machine to be opposed by the reactive forces exerted by the other machine, thus reducing the resultant forces transmitted into the foundation.

1,612,332. CONDUIT CAP: W. H. Vibber, New London, Conn. App. filed April 10, 1924.

1,612,336, 1,612,337. METHOD OF ATTACHING CONDUCTORS TO BRUSHES; G. C. Wilson and W. J. Mills, St. Mary's, Pa. Apps. filed Feb. 16, 1921, and Nov. 3, 1924.

1,612,340. LUMINOUS TUBE USING RAREFIED GASES; J. B. Abadie, Paris, France. App. filed Feb. 18, 1925.

1,612,347. FIELD DISCHARGE SWITCH; W. M. Austin, Swissvale, Pa. App. filed May 19, 1923.

1,612,348. SWITCH BOX; H. G. Baxter, Baldwin, N. Y. App. filed Sept. 25, 1919. Safety switch box.

1,612,351. WATERWHEEL REGULATOR; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 26, 1924.

1,612,353. MATERIAL FOR CATENARY CONSTRUCTION; P. H. Brace, Wilkinsburg, Pa. App. filed July 13, 1922.

1,612,354. GAP IONIZER; Q. A. Brackett, Pittsburgh, Pa. App. filed Nov. 3, 1919. Lightning arresters in which electrodes made of film-forming material, such as aluminum, are immersed in a suitable electrolyte, and whereby the films may be reformed on such electrodes.

1,612,358. INSULATOR; J. M. Brown, Pittsburgh, Pa. App. filed Jan. 12, 1920. Pin type.

1,612,363. RELAY; L. Dorfman, Wilkinsburg, Pa. App. filed Oct. 4, 1924. Electromagnetic series cut-out relay for series lighting circuits.

1,612,373. TRANSFORMER TERMINAL; J. B. Hansell and B. Reesley, Manchester, England. App. filed May 7, 1923. Weatherproof terminal in which a plurality of leads or tappings pass through a single insulating bushing.

1,612,375. THERMAL RELAY; H. D. Hineline, Pittsburgh, and W. G. Mylius, Wilkinsburg, Pa. App. filed March 5, 1923.

1,612,381. STORAGE-BATTERY TERMINAL; R. Koch, Milwaukee, Wis. App. filed Dec. 14, 1925.

1,612,387. IONIC-DISCHARGE LAMP AND PROCESS OF MANUFACTURING SAME; R. R. Machlett, New York, N. Y. App. filed Nov. 25, 1924.

1,612,388. APPARATUS FOR AUTOMATIC WELDING; A. M. MacFarland, Wilkinsburg, Pa. App. filed Dec. 29, 1923.

1,612,422. ELECTRIC APPARATUS; P. R. Dijksterhuis, Eindhoven, Netherlands. App. filed Feb. 18, 1925. The attachment of a filament for a high current intensity to a leading-in wire in an electric apparatus, which may be, for example, an electric incandescent lamp or an electric discharge tube.

1,612,438. GLOW CATHODE RECTIFIER; G. Holst, W. O. Julius and E. Oosterhuis, Eindhoven, Netherlands. App. filed July 28, 1923.

1,612,459. INCANDESCENT LAMP; O. V. Maurer, East Cleveland, Ohio. App. filed July 17, 1925. Having a filamentary material possessing special physical and electrical properties. An incandescing body for electric lamps consisting of an alloy containing from 50 per cent to 99 per cent metallic tantalum and 1 per cent to 50 per cent of metallic tungsten combined in the form of a homogeneous alloy.

1,612,477. FLOAT-OPERATED CIRCUIT CLOSER; J. W. Walker, Topeka, Kan. App. filed Dec. 26, 1925.

1,612,483. OIL-SWITCH-OPERATING DEVICE; R. Wilkins, San Francisco, A. T. Church, Oakland, and A. K. Ingraham, Berkeley, Cal. App. filed May 18, 1925.

1,612,486. CIRCUIT CLOSER; R. A. Borey, New Orleans, La. App. filed April 22, 1925. Which will function to close a circuit, as, for instance, an alarm circuit, when the fuse of the device is melted.

1,612,537. LEADING-IN WIRE-LOCATING DEVICE; O. J. Schroeder, Milwaukee, Wis. App. filed Aug. 29, 1924. Machine for manufacturing tipless lamp stems.

1,612,547. VAPOR ARC DEVICE; E. R. Stoekle, Milwaukee, Wis. App. filed May 24, 1918. Mercury-arc rectifier.

1,612,552. CIRCUIT-INTERRUPTING SYSTEM; H. A. Travers, Forest Hills Borough, and C. McL. Moss, Pittsburgh, Pa. App. filed Feb. 4, 1921. Remotely controlled circuit interrupter to prevent an electrically operated circuit interrupter from being held closed when a short circuit or heavy overload obtains on the circuit controlled thereby. To provide a master switch for controlling the closing circuits of a plurality of interrupters in an electrical system, to render the closing circuits of the several interrupters ineffective after the automatic tripping of one interrupter until the master switch may be reset.

1,612,576. SEALING AND INSULATING COMPOSITION; H. I. Grant and W. R. Farren, Tamaqua, Pa. App. filed June 25, 1925.

1,612,648. TROLLEY CONSTRUCTION FOR ELECTRIC CRANES; C. H. Pollard, Wheelersburg, Ohio. App. filed May 26, 1926.

1,612,661. INTRODUCTION OF HYGROSCOPIC MATERIAL INTO EVACUATED DEVICES; W. C. Sproesser, Bloomfield, N. J. App. filed July 16, 1923. Method of introducing a stable substance into an evacuated bulb, the substance being so prepared that it will not normally absorb moisture, but upon heating will generate a hygroscopic material, for example, phosphorus pentoxide, for the purpose of absorbing traces of moisture which may be left therein.

1,612,664. STAND FOR ELECTRIC IRONS; H. Taylor, Wheeling, W. Va. App. filed Feb. 10, 1925.

1,612,711. ELECTRICAL SWITCH; E. J. Erikson, Vesteras, Sweden. App. filed Oct. 18, 1923. Consists of a plug switch or a similar hand-operated switch and a quick-break switch connected in series therewith.

(Issued Jan. 4, 1927)

1,612,828. ELECTRICAL MACHINE; C. A. Mudge, Elizabeth, N. J. App. led March 31, 1925. Intended to be installed in various restricted locations. To provide machines for such use, the parts of which may be readily made accessible for inspection and repair.

1,612,856. LIGHTING UNIT; L. C. Doane, Meriden, Conn. App. filed Jan. 3, 1925. Of the indirect type, totally inclosed and luminous to the eye.

1,612,875. AUTOMATIC-CHARGING AND VOLTAGE-REGULATING SYSTEM; H. F. Obergfell, River Forest, Ill. App. filed June 11, 1919.

1,612,897. THERMOCOUPLE; G. J. Zethmayr, Congress Park, Ill. App. filed March 17, 1926. Multiple-vacuum thermocouple especially adapted for measuring alternating currents of high frequency.

1,612,958. THERMOSTATIC SWITCH; W. W. Williams, Bloomington, Ill. App. filed June 7, 1923. Thermal safety-control mechanism for a fuel-burning device.

1,612,984. BOND-WIRE SUPPORTER; F. A. Preston, Highland Park, Ill. App. filed Dec. 30, 1922.

1,613,003. FOCUSING ARC LAMP; M. J. Wohl, New York, N. Y. App. filed April 10, 1922.

1,613,013. ELECTRICAL FIXTURE-SUPPORTING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed June 23, 1921. Fixture can be readily connected and disconnected with respect to the receptacle, both electrically and mechanically.

1,613,018. REPEATER-LOCKING DEVICE; E. J. Butler, Malden, Mass. App. filed May 12, 1919. Automatic non-interfering repeaters used in fire-alarm telegraph systems.

1,613,025. LIGHTING FIXTURE; H. D'Olier, Jr., Bridgeport, Conn. App. filed Dec. 17, 1924. With a light distributing construction, comprising a translucent diffusing bowl and an opaque reflecting bowl, in which diffused light will be distributed above the plane of the lower edge of the reflecting bowl.

1,613,045. SCALP-TREATMENT DEVICE; W. Meyer, Chicago, Ill. App. filed April 3, 1926.

1,613,070. BATTERY CONNECTION; A. W. Weimer and J. Smith, Geneseo, Ill. App. filed Aug. 26, 1924.

1,613,075. STAIR-CONTROLLED ELECTRIC LIGHT SWITCH; H. E. Billerbeck, Philadelphia, Pa. App. filed April 29, 1925.

1,613,078. BURNER OR CARBON HOLDER; J. W. Brenkert and K. Brenkert, Highland Park, Mich. App. filed April 17, 1924.

1,613,104. TERMINAL CLAMP; C. F. Hellman, Los Angeles, Cal. App. filed Sept. 23, 1922. For electrical connections and particularly designed to be used in connection with storage batteries.

1,613,189. TROLLEY WHEEL; S. H. Noyes, Newburyport, Mass. App. filed Dec. 11, 1925.

1,613,194. STAND FOR ELECTRICALLY HEATED UTENSILS; G. B. Ratterman, New York, N. Y. App. filed June 4, 1925.

1,613,203. FLASHLIGHT; J. L. Shannon, Springfield, Mass. App. filed March 30, 1926. A light with several electric lamps or bulbs, preferably of different colors and with suitable switches for closing the circuit to any one of the bulbs, or for all of them at the same time, as desired.

1,613,211. PROCESS OF MAKING STORAGE-BATTERY ELEMENTS; L. C. Werking, New York. App. filed July 15, 1922.

1,613,212. SELF-BAKING ELECTRODES; J. Westly, Christiansand, Norway. App. filed Jan. 5, 1925. Provision of a contact supplying electric current to the electrode without substantial loss of voltage.

1,613,261. COMBINED ELECTRIC PLUG AND CONTROLLER; E. Anthony, King County, Wash. App. filed May 11, 1925. A thermostatic current controller adapted for use in connection with electrically heated tools.

1,613,266. ELECTRIC SWITCH; F. F. Dorsey, Rochester, N. Y. App. filed Sept. 24, 1924. In which the contact members are so arranged that no current passes through the springs by which the contact members are held in engagement with each other.

1,613,288. TROLLEY REEL CASING; E. Niksic, Port Richmond, N. Y. App. filed June 21, 1926.

1,613,325. DISCONNECTING STIRRUP AND HOOK; T. F. Johnson, Jr., Atlanta, Ga. App. filed March 18, 1924. Designed for use on high-tension lines where heavy duty is essential, and especially adapted to be interposed in a branch conductor line leading to an oil circuit breaker, or in any other part of the installation where a similar connection is used.

1,613,327. DRY BATTERY; E. E. Meisekothen, Madison, Wis. App. filed May 12, 1924. Comprising a nest of dry cells; a method of producing the nest, or container, in which the dry cells are housed.

1,613,332. STREET-CAR BARN; W. F. Snohr, Chicago, Ill. App. filed Oct. 6, 1924. Means for moving cars out of the barn in case of a fire and which can be controlled from a point outside of the barn.

1,613,337. COLOR RHEOSTAT; H. C. Weller, Tuscola, Ill. App. filed Dec. 30, 1922. For mixing, blending and shifting colors of electric lighting.

1,613,412. OIL-INSULATED TRANSFORMER; W. Sarfert, Dresden, and F. Haberle, near Dresden, Germany. App. filed Dec. 19, 1923. Having a hollow open-ended bushing extending upwardly from the casing and dowriwardly into the casing and adapted to provide for the expansion and contraction of the insulating liquid within the casing under atmospheric conditions.

1,613,426. PROCESS OF PRODUCING ELECTRICAL HEATING ELEMENT; E. L. Wiegand, Pittsburgh, Pa. App. filed Aug. 31, 1923. Of the sheathed class.

1,613,437. CUT-OUT AND FUSE BOX; S. Bromberg, Brooklyn, N. Y. App. filed Dec. 24, 1924.

1,613,446. ELECTRICAL RELAY SWITCH; G. Dumont, Esneux, near Liege, Belgium. App. filed Nov. 30, 1923. Of the kind used in electric bell circuits.

1,613,464. REINFORCED INSULATOR; W. D. Kyle, Milwaukee, Wis. App. filed March 9, 1923. Of the type adapted to be secured to a stationary support.

1,613,517. CONTROL SWITCH; J. R. Kelley, Covington, Ky. App. filed June 2, 1921. Which will preclude initial overloading of a motor and may be used to lock automatically a circuit-closing mechanism against closing unless the mechanisms are in their proper relation before starting the motor.

1,613,520. APPARATUS FOR RECORDING THE DURATION OF VERY BRIEF PHENOMENA; P. A. Marti, Philippeville, Algeria. App. filed July 24, 1923.

1,613,585, 1,613,586. DRY BATTERY; H. M. Rosendal Dam, Astoria, N. Y. Apps. filed Aug. 13, 1923, and Dec. 2, 1924. Of the kind in which each unit is in the form of a plate, each plate being composed of electrodes in plate form between which an electrolyte is confined.